

Un-Locking the River

Addressing Riparian Ecosystems and Public Recreation Opportunities
Along the Mississippi River Gorge in Minneapolis, Minnesota



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Thesis Research & Design

LA 572 | Jay Kost | Matthew Kirkwood | Spring 2019

Personal Interest



Personal Interest



Why Remove Dams?

“Few things have such a **FUNDAMENTAL IMPACT** on a river as a **DAM**.

Dams **BLOCK** the movement of fish and other aquatic species, **INUNDATE** river habitat, **IMPAIR** water quality, and **ALTER** the flow regime necessary to sustain river life.

As dams **AGE** and **DECAY**, they can also become public safety **HAZARDS**, presenting a **FAILURE RISK** and a **DANGEROUS NUISANCE.**”

-AmericanRivers.org

How Dams Harm Rivers

Dams Prevent Species Migration

Slow Currents & Disrupted Flow Patterns

Sediments Cover Aquatic Habitats

Slow Water Can Cause Poor Water Quality

Old Infrastructure Poses Human Safety Hazards



Research Hypothesis

As **LOCK AND DAMS** continue to become **DEFUNCT** around the country, how can **PLANT COMMUNITIES** best be used to **RESTORE** unique habitats and **CONTROL** erosion while also **SERVING** local communities and **SOCIETY** as a whole?

Case Study - Sandstone Dam

Project Typology

- 1) **Dam Removal**
- 2) River Restoration
- 3) Aquatic Habitat
- 4) Public Safety
- 5) **Whitewater Ecosystem**

Context

- 1) **Kettle River** - Minnesota Wild and Scenic River
- 2) Upstream of St. Croix River (**Mississippi Watershed**)
- 3) **Banning State Park**, Sandstone, MN
- 4) Dam built **1908**
- 5) **20' High x 150' Long**
- 6) Hydropower Restoration: **\$1,000,000**
Dam Removal: **\$208,000**
- 7) Dam removed **1995**



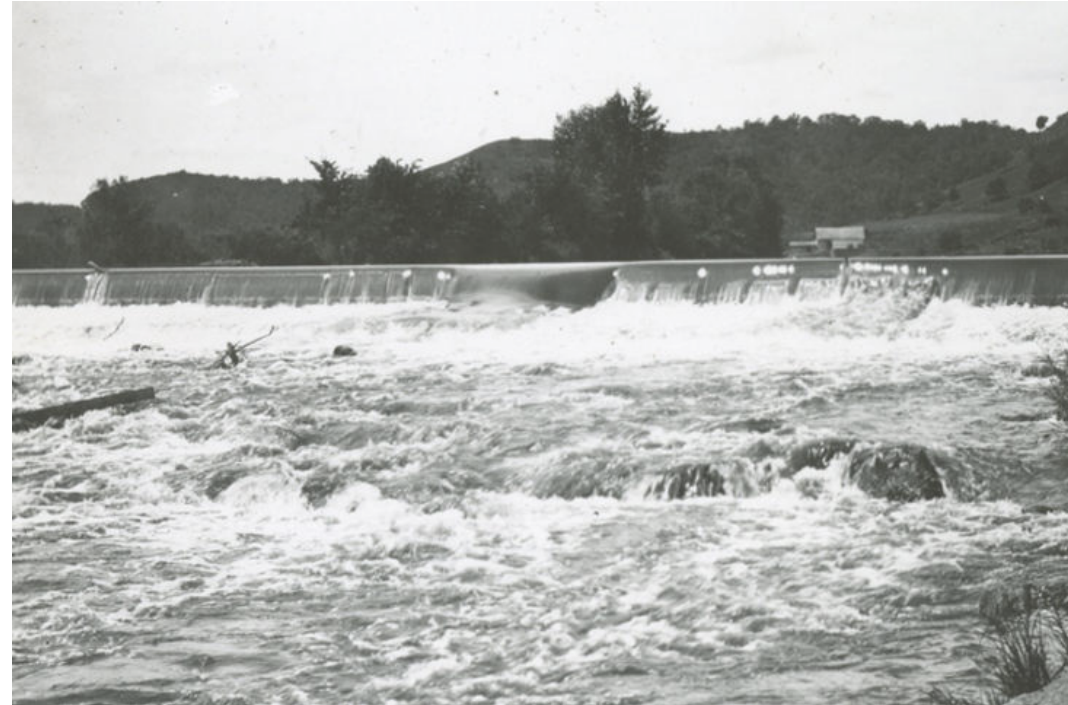
Case Study - Welch Dam

Project Typology

- 1) **Dam Removal**
- 2) River Restoration
- 3) Aquatic Habitat
- 4) Public Safety
- 5) **Aquatic Recreation**

Context

- 1) **Cannon River**
- 2) 13 miles upstream of **Mississippi River**
- 3) **Banning State Park**, Sandstone, MN
- 4) Dam built **1890**, rebuilt **1920s**
- 5) Hydropower closed **1960s**
- 6) **6 deaths** between 1960s-1990s
- 7) Dam Removal: **\$46,000**
- 8) Dam removed **1994**
- 9) **Whitewater Rafting** business established



Case Study - Buffalo Bayou Promenade

Project Typology

- 1) Riparian Restoration
- 2) **Ecosystem Restoration**
- 3) Public Park
- 4) Green Infrastructure
- 5) Urban Design
- 6) **Erosion Control**

Context

- 1) **Buffalo Bayou**, Houston, Texas
- 2) **Urban** Riparian System
- 3) Located near **Downtown**
- 4) Constructed **2001-2006**
- 5) Native plants used for **erosion control**
- 6) Used for **flood control**



Plant Communities Research

Large Trees

Common Name	Latin Name	Mature Height	Mature Width	Hardiness Zone	Native/Exotic	Root Depth (in)	Growth Rate	Fall Color	Winter Interest	Exposure	Tolerance	Life Span
Box Elder	Acer negundo	70'	50'	3, 9	Native	40	Fast	2	No	Full Sun	High	Short
Norway Maple	Acer platanoides	50'	38'	3, 7	Exotic	40	Fast	2	No	Part Shade	Moderate	Medium
Red Maple	Acer rubrum	60'	60'	3, 9	Native	30	Fast	3	No	Full Sun	Low	Short
Silver Maple	Acer saccharinum	120'	80'	4, 8	Native	32	Fast	3	No	Full Sun	High	Medium
Sugar Maple	Acer saccharum	80'	60'	3, 8	Native	40	Medium	3	No	Part Shade	Moderate	Long
Prairie Torch Buckeye	Aeschulus glabra 'Bergeson'	38'	38'	3, 7	Exotic	36	Medium	3	No	Part Shade	High	Short
Yellow Birch	Betula alleghaniensis	80'	30'	3, 7	Native	30	Medium	3	Yes	Full Shade	Moderate	Medium
River Birch	Betula nigra	70'	60'	3, 9	Native	20	Fast	2	No	Part Shade	High	Short
Paper Birch	Betula papyrifera	70'	35'	2, 6	Native	24	Fast	3	Yes	Full Sun	Moderate	Medium
European White Birch	Betula pendula	50'	30'	2, 6	Exotic	24	Fast	2	Yes	Full Sun	Moderate	Short
Prairie Sentinel Hackberry	Celtis occidentalis 'JFS-KSUI'	45'	12'	4, 9	Exotic	36	Medium	2	No	Full Sun	Moderate	Medium
American Beech	Fagus grandifolia	80'	80'	4, 9	Native	32	Slow	3	Yes	Full Sun	Low	Long
Ginkgo	Ginkgo biloba	80'	40'	3, 8	Exotic	35	Slow	2	No	Full Sun	Moderate	Long
Thornless Honey Locust	Gleditsia triacanthos f. inermis	70'	60'	4, 9	Exotic	48	Fast	2	No	Full Sun	High	Medium
Kentucky Coffeetree	Gymnocladus dioicus	75'	50'	3, 8	Native	36	Slow	1	Yes	Full Sun	Moderate	Long
Black Walnut	Juglans nigra	75'	75'	4, 9	Native	40	Slow	1	No	Part Shade	Moderate	Medium
Eastern Red Cedar	Juniperus virginiana	50'	20'	3, 9	Native	20	Medium		Yes	Full Sun	Low	Medium
European Larch	Larix dedidua	75'	30'	2, 6	Exotic	40	Medium	3	Yes	Full Sun	Moderate	Long
American Larch/Tamarack	Larix laricina	80'	30'	1, 5	Native	12	Slow	2	No	Full Sun	High	Medium
Norway Spruce	Picea abies	60'	30'	3, 7	Exotic	28	Fast		Yes	Full Sun	Moderate	Medium
Black Hills Spruce	Picea glauca 'Densata'	40'	15'	3, 6	Native	30	Medium		Yes	Full Sun	High	Medium
Black Spruce	Picea mariana	40'	30'	3, 6	Native	16	Medium		Yes	Full Sun	High	Medium
Colorado Spruce	Picea pungens	60'	20'	3, 7	Native	18	Slow		Yes	Full Sun	Moderate	Long
Jack Pine	Pinus banksiana	50'	25'	2, 7	Native	20	Slow		Yes	Full Sun	Low	Short
Austrian Pine	Pinus nigra	60'	40'	3, 7	Exotic	40	Medium		Yes	Full Sun	Moderate	Long
Ponderosa Pine	Pinus ponderosa	150'	40'	3, 7	Exotic	20	Medium		Yes	Full Sun	Moderate	Long
Norway Pine	Pinus resinosa	80'	25'	2, 5	Exotic	40	Medium		Yes	Full Sun	Low	Medium
Eastern White Pine	Pinus strobus	80'	40'	3, 7	Native	40	Fast		Yes	Full Sun	Moderate	Medium
Scotch Pine	Pinus sylvestris	60'	40'	2, 7	Exotic	20	Medium		Yes	Full Sun	Moderate	Medium
Eastern Cottonwood	Populus deltoides	100'	75'	3, 9	Native	24	Fast	2	No	Full Sun	High	Short
Quaking Aspen	Populus tremuloides	50'	30'	1, 6	Native	32	Fast	3	No	Part Shade	Moderate	Short
White Oak	Quercus alba	80'	80'	3, 9	Native	48	Slow	2	No	Full Sun	Moderate	Long
Bur Oak	Quercus macrocarpa	80'	80'	3, 8	Native	28	Slow	1	No	Full Sun	High	Long
Pin Oak	Quercus palustris	70'	45'	4, 8	Native	30	Fast	2	No	Full Sun	High	Medium
Red Oak	Quercus rubra	75'	75'	4, 8	Native	36	Fast	2	No	Full Sun	Low	Long
White Willow	Salix alba	100'	100'	2, 8	Exotic	24	Fast	3	Yes	Full Sun	High	Medium
Littleleaf Linden	Tilia cordata	70'	45'	3, 7	Exotic	26	Medium	2	No	Full Sun	Moderate	Medium
American Elm	Ulmus americana	80'	55'	3, 9	Native	42	Fast	2	No	Part Shade	High	Medium

Plant Communities Research

Small Trees

Common Name	Latin Name	Mature Height	Mature Width	Hardiness Zone	Native/Exotic	Growth Rate	Fall Color	Winter Interest	Exposure	Tolerance	Root Depth (ft)	Life Span
Amur Maple	Acer ginnala	20'	20'	3, 8	Exotic	Medium	2 No	Part Shade	Moderate	24 Medium	24 Medium	Medium
Rocky Mountain Maple	Acer grandidentatum 'Schmidt'	25'	15'	4, 8	Exotic	Medium	3 No	Part Shade	Moderate	24 Medium	24 Medium	Medium
Paperbark Maple	Acer glabrum	30'	30'	4, 8	Exotic	Slow	2 Yes	Full Sun	Moderate	24 Medium	24 Medium	Medium
Manchurian Maple	Acer mandshuricum	25'	25'	4, 6	Exotic	Medium	2 Yes	Full Sun	Moderate	24 Medium	24 Medium	Medium
Korean Maple	Acer pseudosieboldianum	25'	25'	4, 8	Exotic	Medium	3 Yes	Full Sun	Moderate	24 Medium	24 Medium	Medium
Tatarian Maple	Acer tataricum	20'	20'	3, 8	Exotic	Medium	2 No	Full Sun	Moderate	24 Medium	24 Medium	Medium
Three-flowered Maple	Acer triflorum	30'	30'	4, 7	Exotic	Slow	1 Yes	Full Sun	Moderate	24 Medium	24 Medium	Medium
Shantung Maple	Acer truncatum	25'	20'	4, 8	Exotic	Slow	3 No	Full Sun	Moderate	24 Medium	24 Medium	Medium
Speckled Alder	Alnus incana ssp. Rugosa	25'	25'	3, 6	Native	Fast	1 No	Part Shade	High	24 Long	24 Long	Long
Allegheny Serviceberry	Amelanchier laevis	25'	25'	4, 8	Native	Medium	1 No	Full Sun	Moderate	24 Medium	24 Medium	Medium
American Hornbeam	Carpinus caroliniana	30'	30'	3, 9	Native	Slow	2 Yes	Full Shade	Moderate	20 Short	20 Short	Short
Pigoda Dogwood	Cornus alternifolia	25'	25'	3, 7	Native	Slow	2 No	Full Sun	Moderate	20 Medium	20 Medium	Medium
Downy Hawthorn	Crataegus mollis	30'	30'	3, 6	Native	Medium	1 No	Full Sun	Moderate	20 Medium	20 Medium	Medium
Dotted Hawthorn	Crataegus punctata	30'	30'	4, 7	Native	Medium	2 No	Full Sun	Moderate	20 Medium	20 Medium	Medium
Winterberry Euonymus	Euonymus bungeanus 'Verona'	20'	20'	4, 7	Exotic	Fast	3 No	Part Shade	Low	20 Short	20 Short	Short
Common Juniper	Juniperus communis	15'	12'	2, 7	Native	Slow	Yes	Full Sun	Low	14 Long	14 Long	Long
Flowering Crabapple	Malus 'Adams'	25'	25'	4, 8	Exotic	Medium	2 Yes	Full Sun	Moderate	30 Medium	30 Medium	Medium
American Hophornbeam	Ostrya virginiana	30'	20'	3, 9	Native	Slow	2 No	Part Shade	Low	16 Short	16 Short	Short
Prinyon Pine	Pinus edulis	30'	25'	4, 8	Exotic	Slow	Yes	Full Sun	Moderate	20 Long	20 Long	Long
American Plum	Prunus americana	25'	25'	3, 8	Native	Medium	2 No	Full Sun	Moderate	24 Long	24 Long	Long
Canada Plum	Prunus nigra	30'	20'	2, 6	Native	Fast	1 No	Full Sun	Moderate	36 Medium	36 Medium	Medium
Pin Cherry	Prunus pensylvanica	30'	20'	2, 6	Native	Fast	3 No	Full Sun	Moderate	20 Short	20 Short	Short
Common Chokeberry	Prunus virginiana	30'	25'	2, 6	Native	Medium	2 No	Part Shade	Low	20 Short	20 Short	Short
Common Pear	Pyrus communis	30'	20'	4, 8	Exotic	Medium	2 No	Full Sun	Low	30 Short	30 Short	Short
Pein Lilac	Syringa pekinensis 'Morton'	20'	15'	4, 7	Exotic	Medium	1 No	Full Sun	Low	30 Short	30 Short	Short
Japanese Tree Lilac	Syringa reticulata	30'	25'	3, 7	Exotic	Medium	1 No	Full Sun	Low	30 Short	30 Short	Short
Mongolian Linden	Tilia mongolica	30'	25'	3, 5	Exotic	Slow	2 No	Full Sun	Moderate	30 Short	30 Short	Short

Aquatic Species

Common Name	Latin Name	Mature Height	Mature Width	Hardiness Zone	Native/Exotic	Growth Rate	Tolerance	Exposure	Life Span	Root Depth
Sweet Flag	Acorus americanus	3.9'	3'	4, 11	Native	Moderate	Moderate	10 High	Full Sun	Full Sun
Calamus	Acorus calamus	3'	3'	3, 9	Exotic	Fast	Moderate	12 High	Full Sun	Full Sun
Nebraska Sedge	Carex nebrascensis	3'	2.5'	3, 9	Exotic	Fast	Long	10 High	Full Sun	Full Sun
Beaked Sedge	Carex utriculata	4'	2'		Native	Moderate	Moderate	16 High	Full Sun	Full Sun
Fox Sedge	Carex vulpinoidea	3.2'	1.5'		Native	Fast	Long	16 High	Full Sun	Full Sun
Common Spikerush	Eleocharis palustris	3.5'	1'		Native	Fast	Moderate	14 High	Full Sun	Full Sun
Water Horsetail	Equisetum fluviale	3'	3'		Native	Very Fast	Long	6 High	Part Shade	Part Shade
Cottongrass	Eriophorum angustifolium	2.5'	2'		Native	Moderate	Long	10 High	Full Sun	Full Sun
Slender Cottongrass	Eriophorum gracile	1.7'	2'		Native	Fast	Long	10 High	Full Sun	Full Sun
Longstyle Rush	Juncus longistylis	2'	3'		Native	Moderate	Moderate	10 High	Part Shade	Part Shade
Poverty Rush	Juncus tenuis	2'	1'		Native	Slow	Moderate	6 Moderate	Part Shade	Part Shade
Marsh Trefol	Menyanthes trifoliata	8'	2'		Native	Moderate	Moderate	10 High	Part Shade	Part Shade
Pickersweed	Pontederia cordata	3.2'	1'		Native	Moderate	Moderate	10 High	Full Sun	Full Sun
Arrow Leaved Arrowhead	Sagittaria arifolia	2.6'	3'		Native	Moderate	Moderate	14 Moderate	Full Sun	Full Sun
Broad Leaved Arrowhead	Sagittaria latifolia	4.9'	4'		Native	Moderate	Moderate	18 High	Full Sun	Full Sun
Hardstem Bulrush	Schoenoplectus acutus	9.8'	1.5'		Native	Very Fast	Long	14 High	Full Sun	Full Sun
Three Square Bulrush	Schoenoplectus pungens	4.9'	8'		Native	Moderate	Long	14 High	Full Sun	Full Sun
Soft Stem Bulrush	Schoenoplectus tabernaemontani	9'	5'		Native	Very Fast	Long	16 High	Full Sun	Full Sun
Woolgrass	Scirpus cyperinus	5'	4'		Native	Moderate	Long	12 High	Part Shade	Part Shade
Giant Bur Reed	Sparganium eurycarpum	5'	3'		Native	Moderate	Moderate	12 High	Part Shade	Part Shade
Narrowleaf Cattail	Typha angustifolia	6'	3'		Native	Very Fast	Long	10 High	Full Sun	Full Sun
Broad Leaved Cattail	Typha latifolia	9'	4'		Native	Very Fast	Moderate	14 High	Part Shade	Part Shade

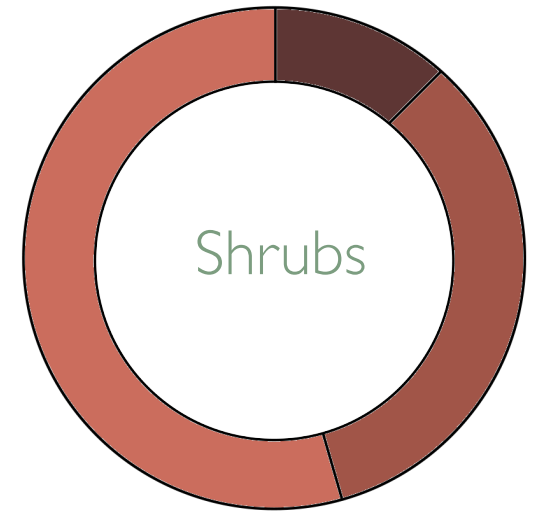
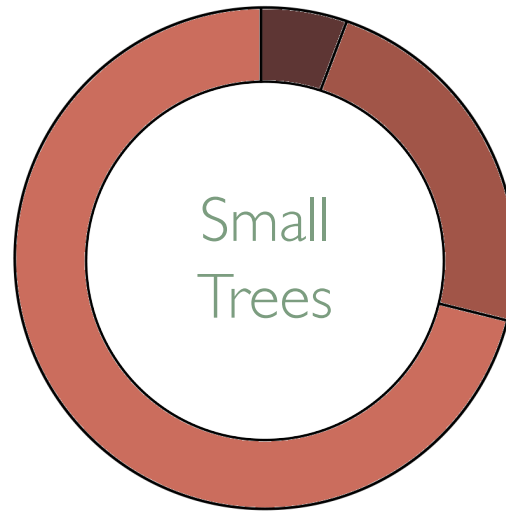
Shrubs

Common Name	Latin Name	Mature Height	Mature Width	Hardiness Zone	Native/Exotic	Growth Rate	Fall Color	Winter Interest	Exposure	Tolerance	Root Depth (ft)	Life Span
False Indigo	Amorpha fruticosa	20'	15'	4, 9	Native	Medium	1 No	Full Sun	Low	24 Medium	24 Medium	Medium
Black Chokeberry	Aronia melanocarpa	10'	10'	3, 8	Native	Medium	3 Yes	Full Sun	High	20 Medium	20 Medium	Medium
Bog Birch	Betula pumila	8'	6'	2, 5	Native	Slow	1 No	Full Sun	High	18 Short	18 Short	Short
Silky Dogwood	Cornus amomum var. schuetzeana	10'	10'	4, 8	Exotic	Fast	1 No	Part Shade	High	16 Medium	16 Medium	Medium
Gray Dogwood	Cornus racemosa	15'	15'	3, 8	Native	Slow	1 Yes	Full Shade	High	16 Medium	16 Medium	Medium
Red Osier Dogwood	Cornus sericea	9'	10'	2, 7	Native	Fast	2 Yes	Part Shade	High	20 Medium	20 Medium	Medium
American Hazelnut	Corylus americana	18'	12'	3, 9	Native	Fast	1 No	Part Shade	High	20 Short	20 Short	Short
Beaked Hazelnut	Corylus cornuta subsp. Cornuta	8'	8'	4, 8	Native	Medium	1 No	Part Shade	High	16 Long	16 Long	Long
Dwarf Bush Honeysuckle	Diervilla lonicera	3'	3'	3, 7	Native	Medium	1 No	Part Shade	High	16 Long	16 Long	Long
Winterberry	Ilex verticillata var. verticillata	10'	10'	3, 9	Native	Slow	1 No	Part Shade	High	16 Medium	16 Medium	Medium
Ninebark	Physocarpus opulifolius	10'	10'	2, 7	Native	Fast	2 No	Part Shade	Low	14 Medium	14 Medium	Medium
Smooth Sumac	Rhus typhina	15'	15'	3, 9	Native	Fast	3 Yes	Full Sun	Moderate	24 Short	24 Short	Short
Staghorn Sumac	Rhus typhina	15'	15'	4, 8	Native	Medium	1 No	Full Sun	Moderate	24 Short	24 Short	Short
Allegheny Blackberry	Rubus allegheniensis	7'	7'	4, 8	Native	Medium	2 No	Full Sun	Moderate	12 Short	12 Short	Short
Black Raspberry	Rubus idaeus subsp. Strigosus	6'	6'	3, 7	Native	Medium	1 No	Full Sun	Moderate	12 Short	12 Short	Short
Black Raspberry	Rubus occidentalis	6'	6'	4, 9	Native	Medium	1 No	Full Sun	Moderate	12 Short	12 Short	Short
Pussy Willow	Salix discolor	15'	15'	4, 8	Native	Medium	1 No	Full Sun	Moderate	20 Long	20 Long	Long
Common Elderberry	Sambucus canadensis var. canadensis	12'	12'	3, 9	Native	Fast	1 No	Full Sun	Moderate	24 Medium	24 Medium	Medium
Red-berried Elder	Sambucus racemosa var. pubens	15'	15'	4, 6	Native	Medium	2 Yes	Full Sun	Moderate	24 Medium	24 Medium	Medium
Snowberry	Symphoricarpos albus	6'	6'	3, 7	Native	Fast	1 No	Full Shade	High	18 Long	18 Long	Long
Common Lilac	Syringa vulgaris	15'	12'	3, 7	Exotic	Medium	1 No	Full Sun	Moderate	14 Medium	14 Medium	Medium
Canada Yew	Taxus canadensis	6'	8'	2, 6	Native	Slow	Yes	Part Shade	Moderate	24 Long	24 Long	Long
Lowbush Blueberry	Vaccinium angustifolium	2'	2'	2, 5	Native	Slow	3 No	Full Sun	Low	16 Medium	16 Medium	Medium
Downy Arrowwood	Viburnum rafinesquianum	6'	8'	3, 7	Native	Slow	2 No	Full Shade	Moderate	14 Medium	14 Medium	Medium

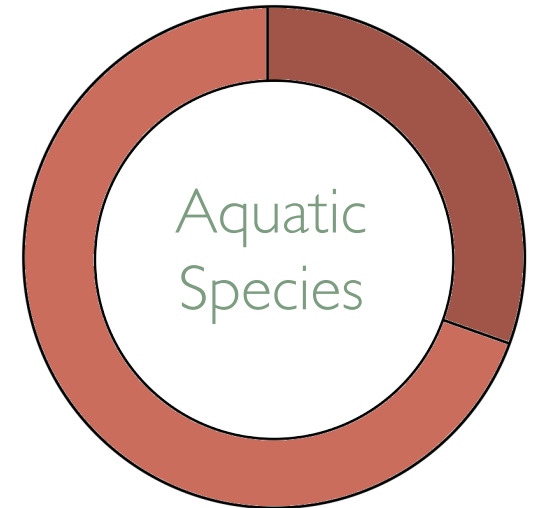
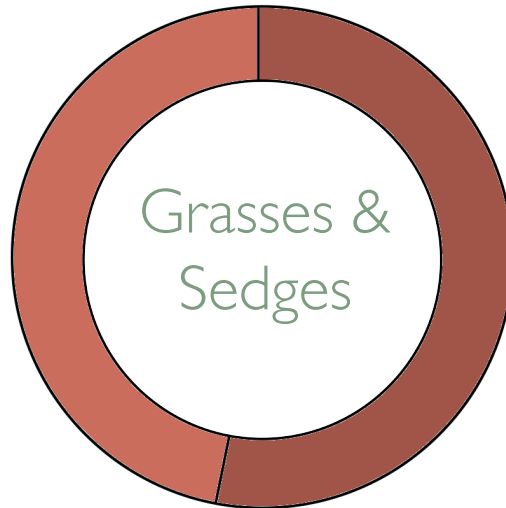
Grasses & Sedges

Common Name	Latin Name	Mature Height	Mature Width	Native/Exotic	Growth Rate	Tolerance	Exposure	Life Span	Root Depth (ft)
Big Bluestem	Andropogon gerardi	6'	3'	Native	Fast	Low	Full Sun	Long	20
American Slough Grass	Beckmannia syzigachne	3'	1'	Native	Moderate	High	Full Sun	Moderate	16
Blue Grama	Bouteloua gracilis	1.25'	2'	Native	Fast	Low	Full Sun	Moderate	16
Fringed Brome	Bromus ciliatus	4'	1'	Native	Moderate	Medium	Part Shade	Long	16
Small Reed Grass	Calamagrostis stricta	3'	4'	Native	Very Fast	Medium	Full Sun	Long	7
Aquatic Sedge	Carex aquatilis	2.9'	2'	Native	Moderate	High	Full Sun	Long	14
Charming Sedge	Carex blanda	2'	1'	Native	Slow	High	Part Shade	Moderate	8
Bottlebrush Sedge	Carex comosa	5'	0.5'	Native	Slow	High	Part Shade	Long	8
Fringed Sedge	Carex cinita	5.2'	2'	Native	Moderate	High	Part Shade	Long	18
Crested Sedge	Carex cristatella	3'	2'	Native	Moderate	Medium	Part Shade	Long	8
Shallow Sedge	Carex lurida	2'	2'	Native	Moderate	High	Part Shade	Long	8
Awl Fruited Sedge	Carex stipata	2.5'	2.5'	Native	Fast	High	Part Shade	Moderate	8
Canada Wild Rye	Elymus canadensis	6'	3'	Native	Very Fast	Low	Full Sun	Short	16
Nodding Fescue	Festuca subverticillata	3'	2'	Native	Moderate	Medium	Part Shade	Moderate	10
Northern Manna Grass	Glyceria borealis	4.9'	1'	Native	Moderate	High	Full Sun	Moderate	14
Northern Sweet Grass	Hierochloa hirta	2.5'	1'	Native	Moderate	Medium	Full Sun	Moderate	14
Junegrass	Koeleria macrantha	1'	1'	Native	Fast	Low	Part Shade	Short	20
Clustered Muhly Grass	Muhlenbergia glomerata	3'	1'	Native	Moderate	Medium	Part Shade	Short	8
Mexican Muhly Grass	Muhlenbergia mexicana	3'	1'	Native	Moderate	Medium	Part Shade	Short	8
Switchgrass	Panicum virgatum	3'	3'	Native	Fast	High	Full Sun	Long	12
Fowl Bluegrass	Poa palustris	4'	2'	Native	Moderate	Medium	Part Shade	Moderate	12
Little Bluestem	Schizachyrium scoparium	4'	2'	Native	Fast	Low	Full Sun	Long	14
Indian Grass	Sorghastrum nutans	3'	2'	Native	Moderate	Low	Full Sun	Long	24
Prairie Cordgrass	Spartina pectinata	6'	7'	Native	Fast	High	Part Shade	Long	18
Prairie Dropseed	Sporobolus heterolepis	1.25'	1.5'	Native	Slow	Low	Full Sun	Moderate	12

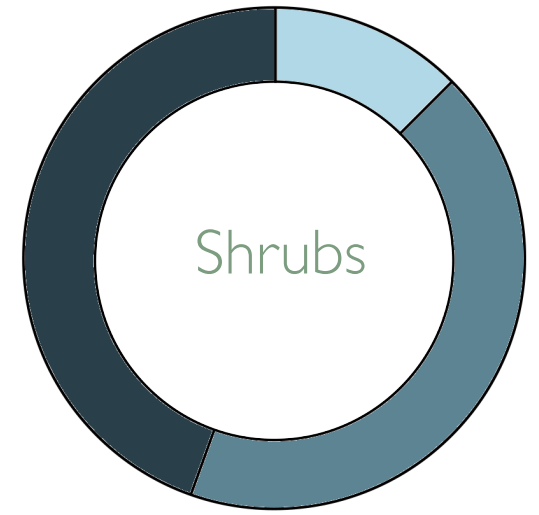
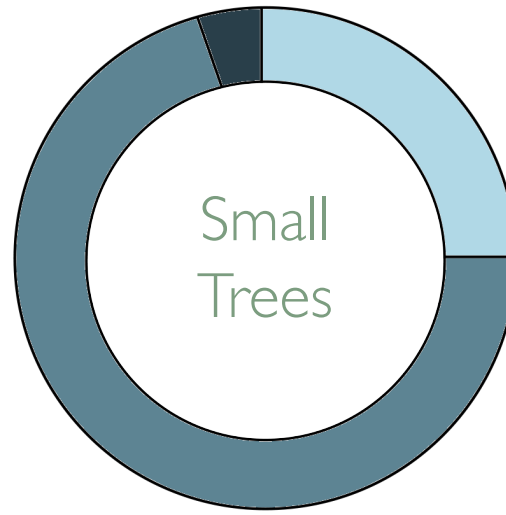
Plant Communities Research



Sun Tolerance



Plant Communities Research



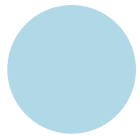
Moisture Tolerance



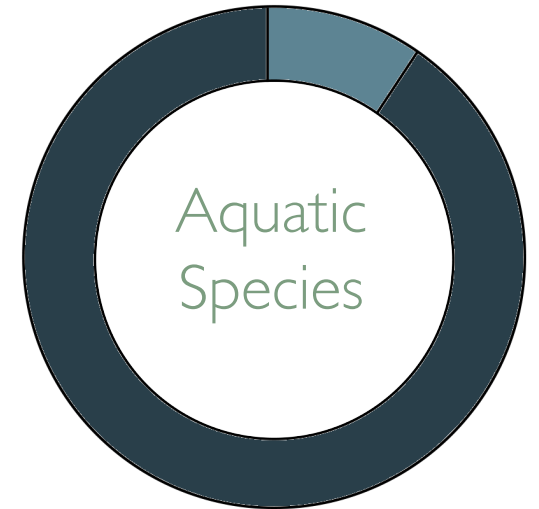
High



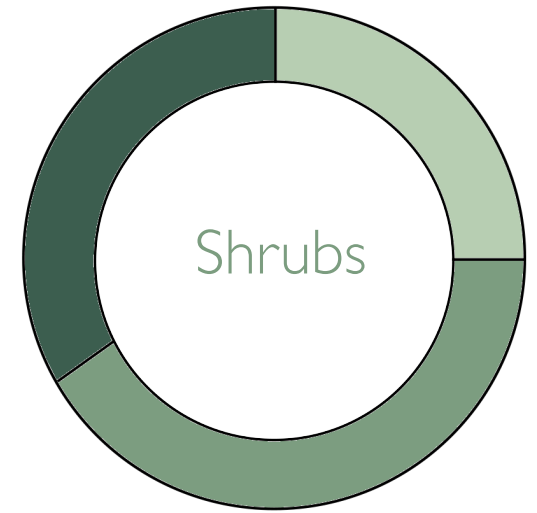
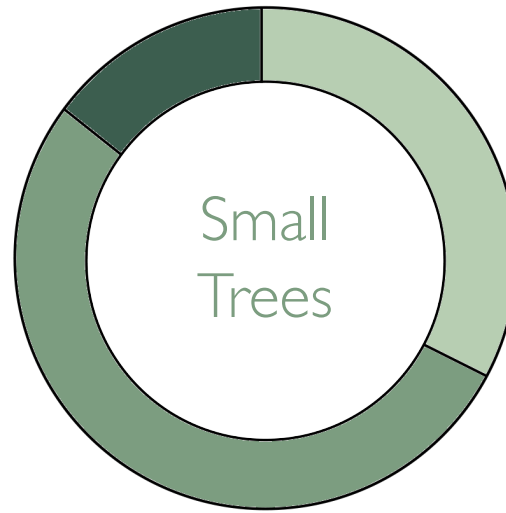
Moderate



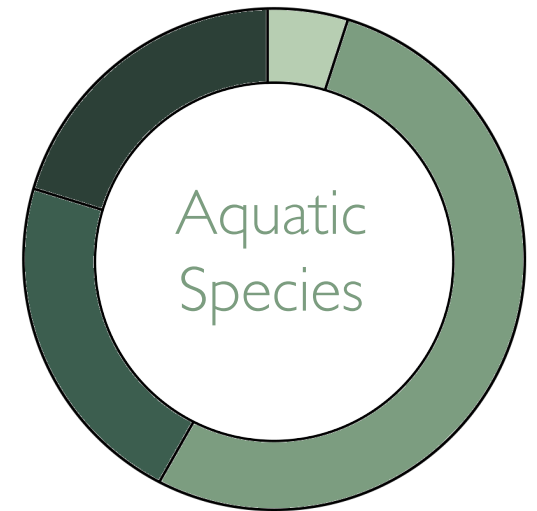
Low



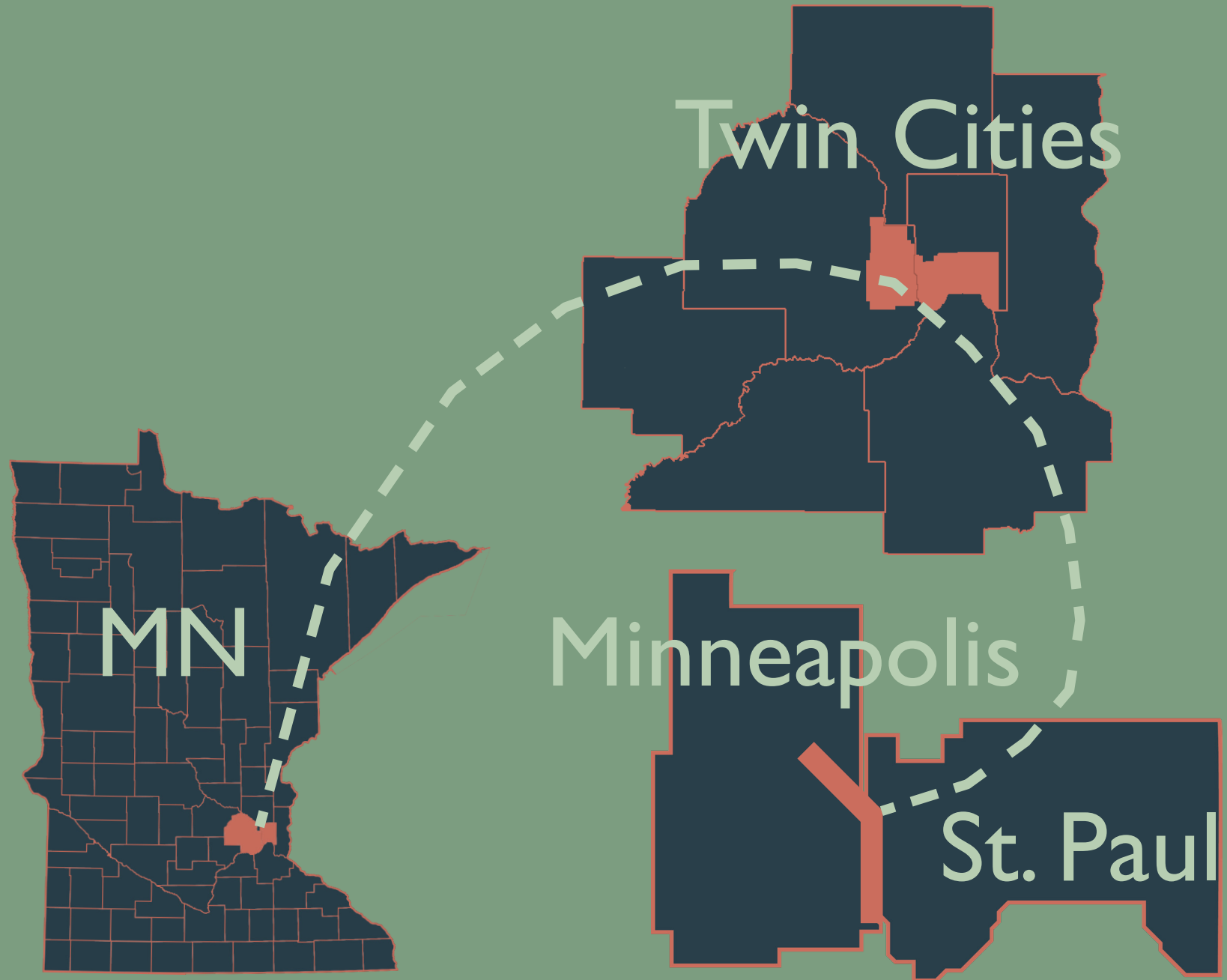
Plant Communities Research



Growth Rate



Mississippi River Gorge









Mississippi River Gorge - Current Site

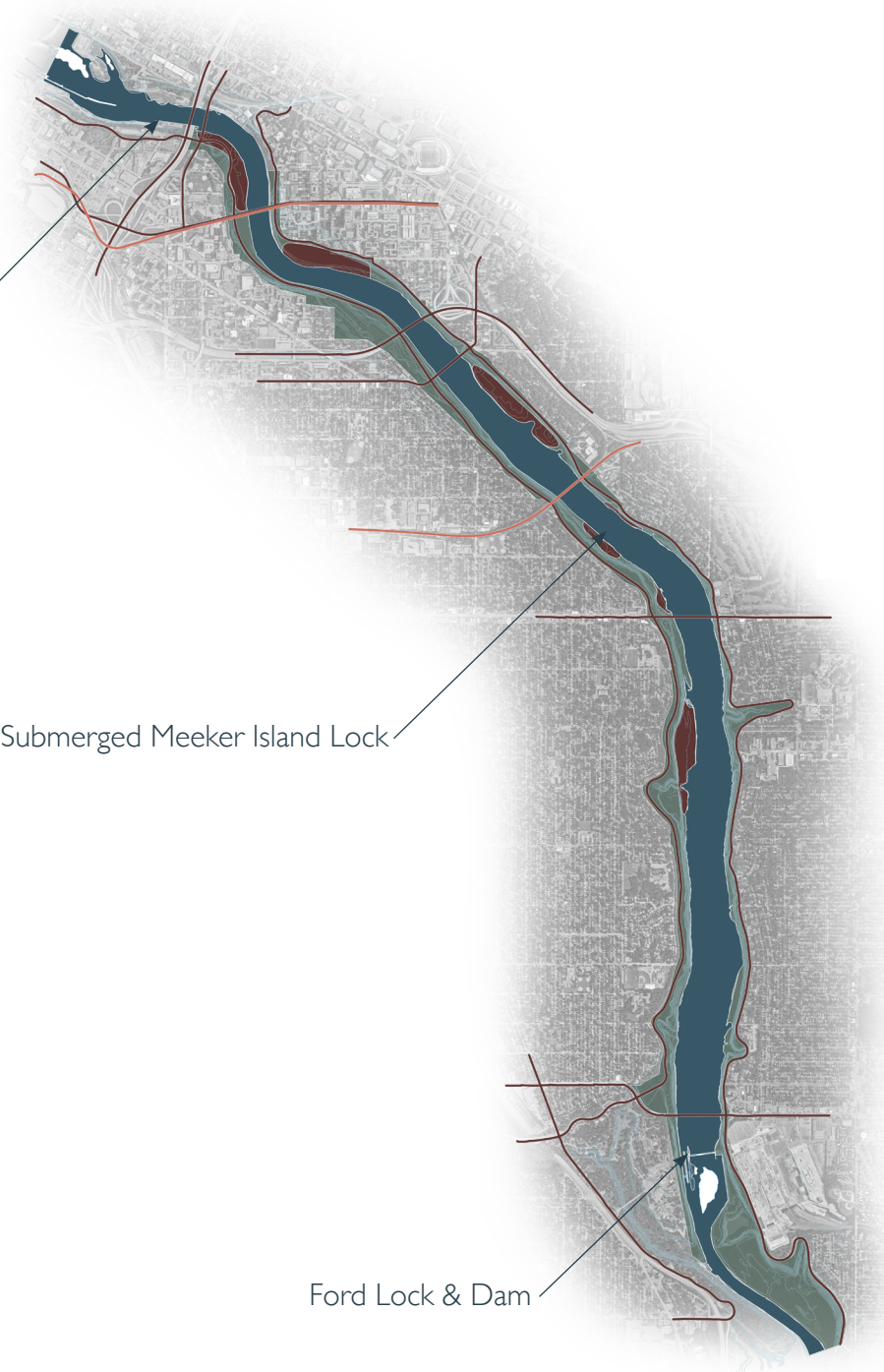
Lower St. Anthony Falls
Lock & Dam

Submerged Meeker Island Lock

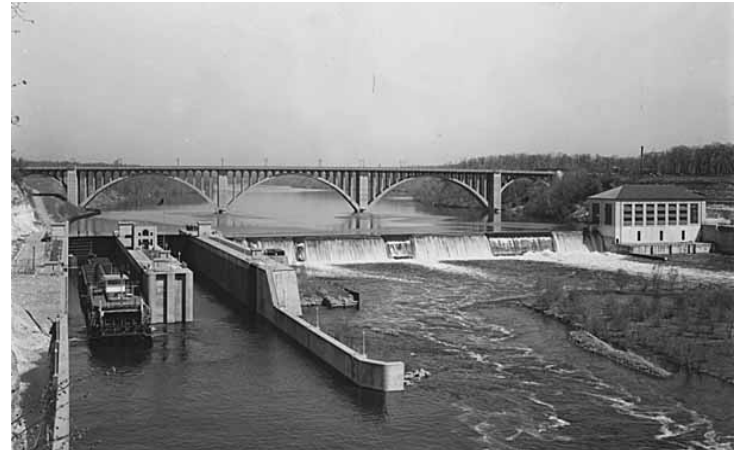
Ford Lock & Dam

Master Key

-  Mississippi River Channel
-  Lowland Typology
-  Park Boundaries
-  Topography Lines
-  Major Roadways
-  Railroads



Mississippi River Gorge - History



Site Photos



Site Photos



Design Focus



Ecosystem

Successfully establish new plant communities, improve existing plant communities, establish historically relevant hydrology including whitewater, rapids, and islands.



Recreation

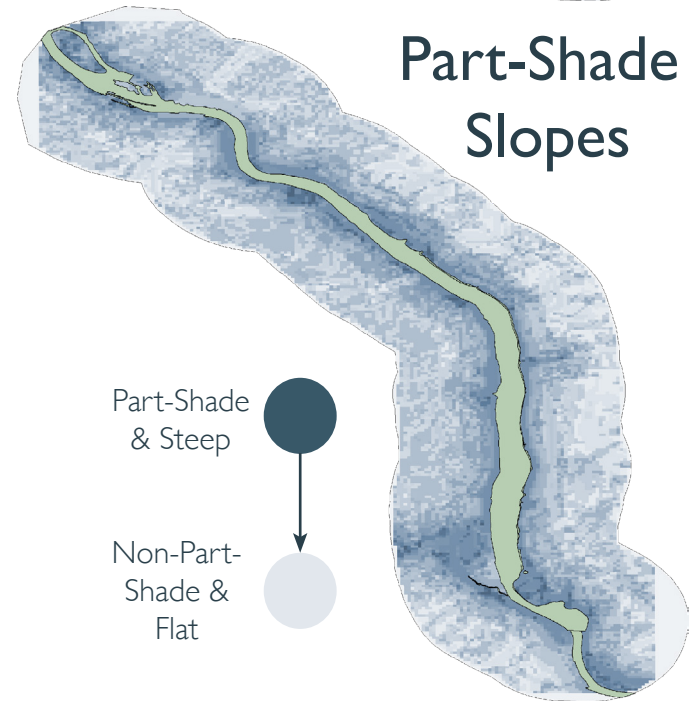
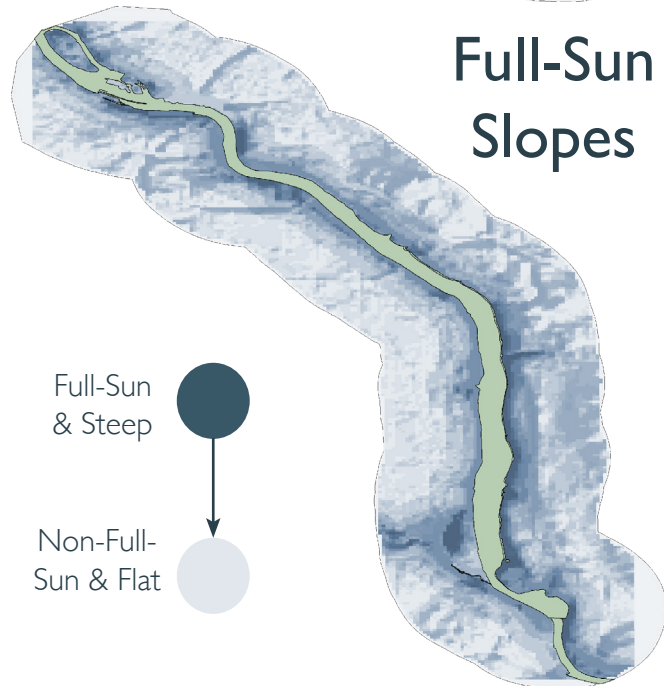
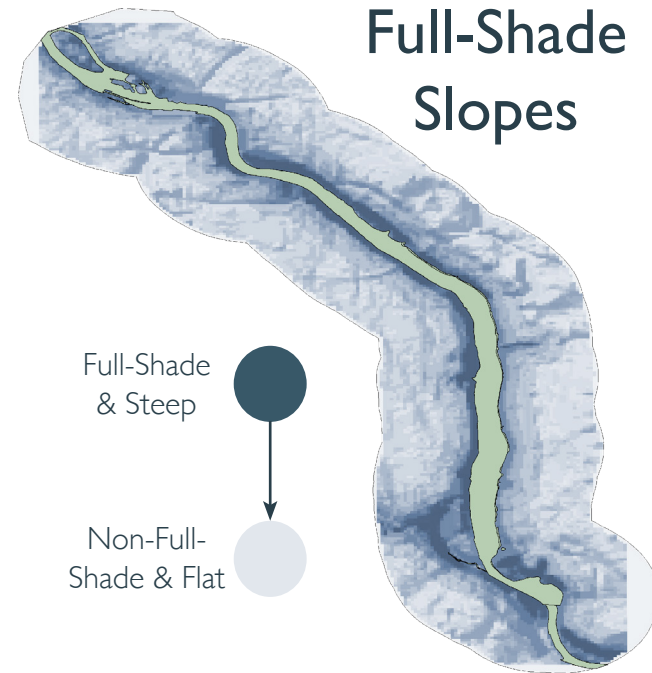
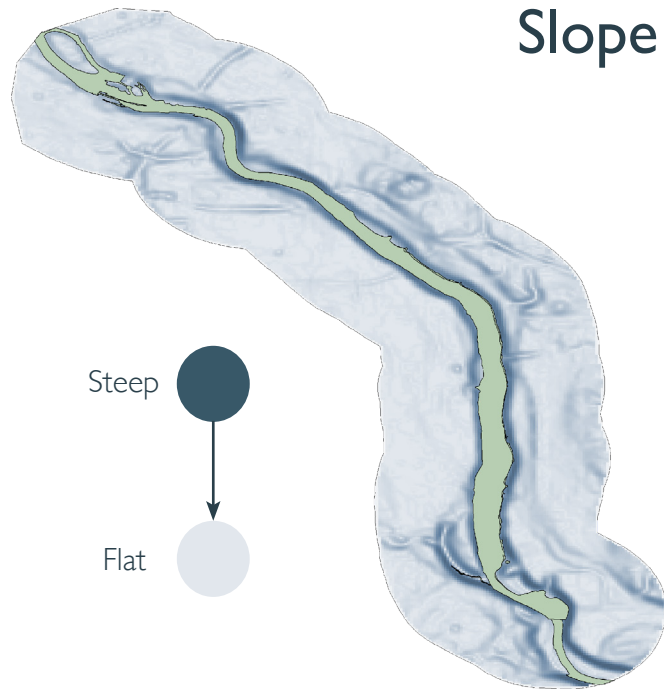
Increase public water access and recreation opportunities throughout the Gorge, including trails, fishing access, whitewater kayaking & rafting.



Education

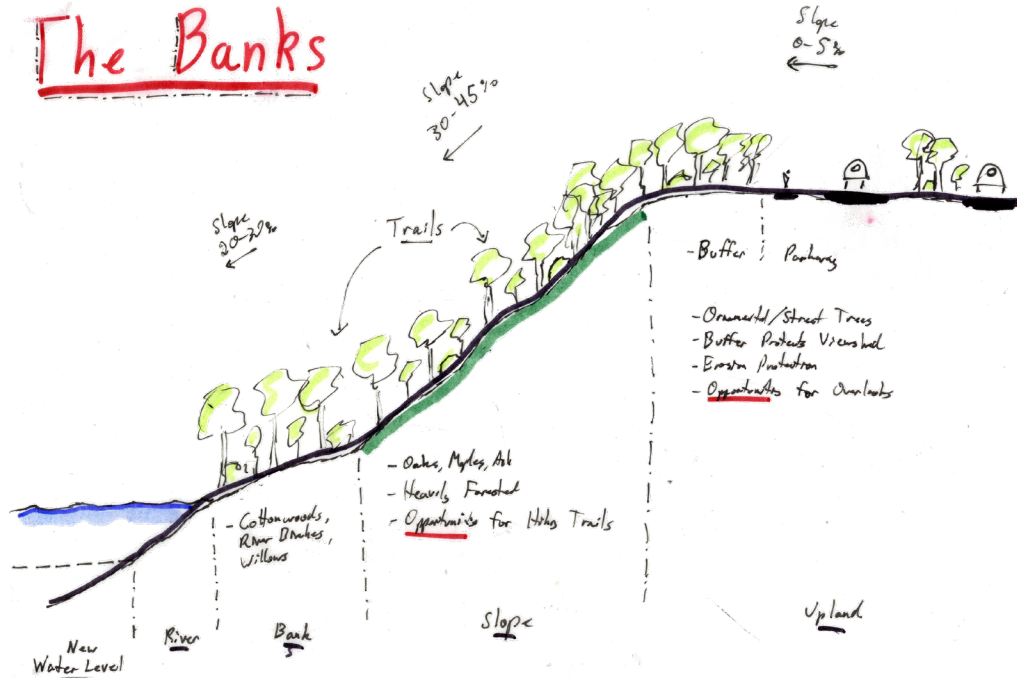
Create new opportunities for public education related to natural systems, history, and culture.

Site Analysis



Gorge Masterplanning - Typologies

The Banks

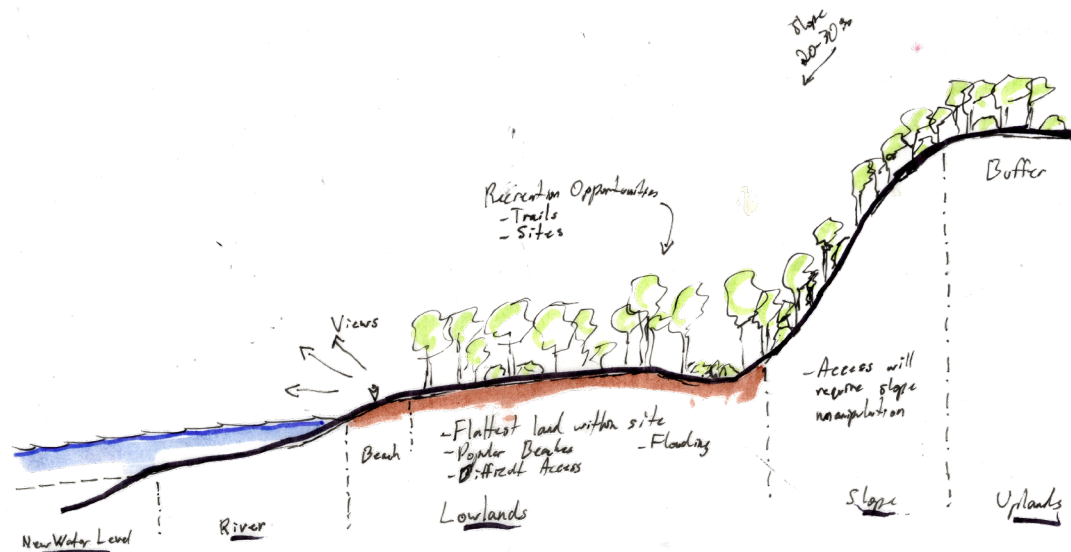


Banks & Lowlands located in Gorge Zone I

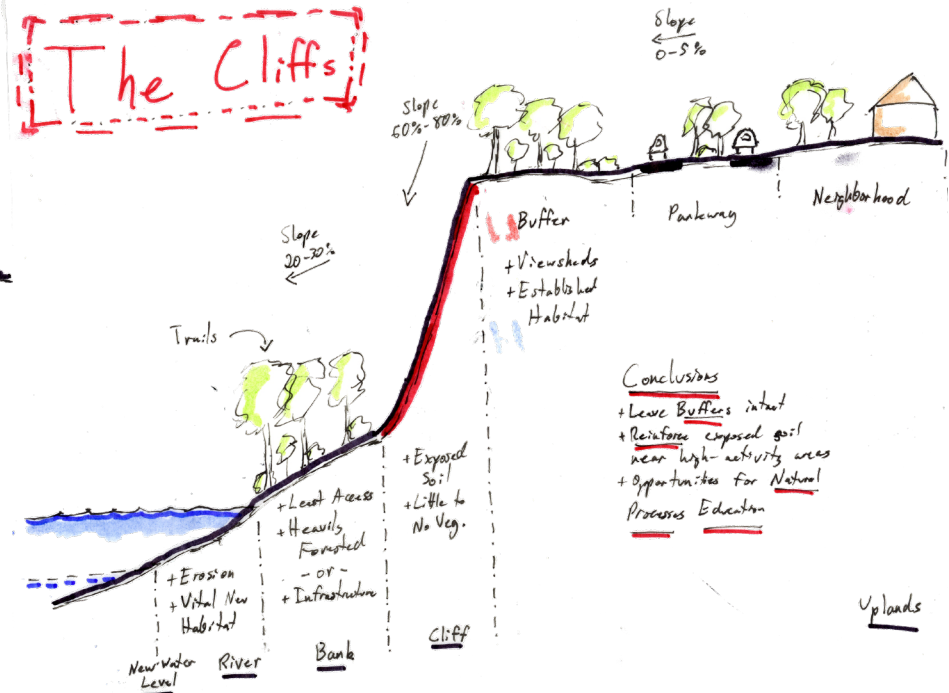
Banks, Lowlands, & Cliffs located in Gorge Zone II

Typologies define gorge edges and **Extent of Design**

The Lowlands



The Cliffs

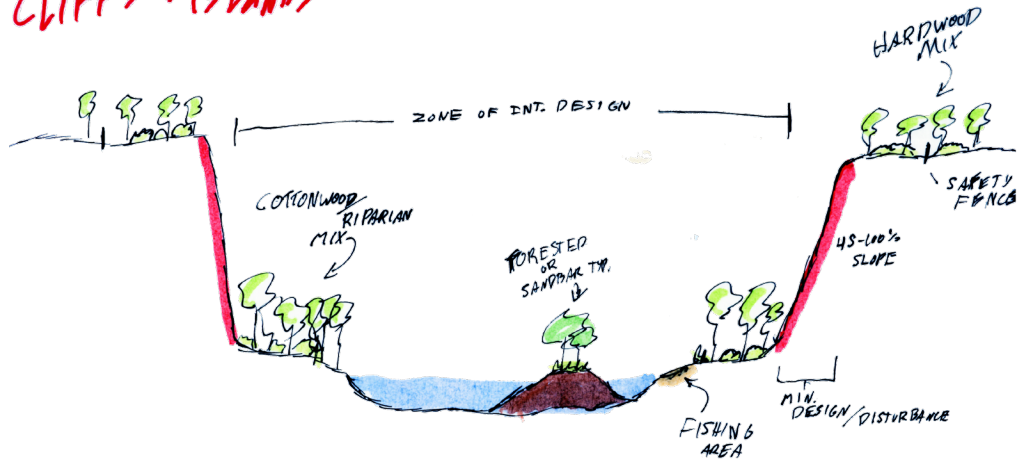


Conclusions

- + Leave Buffers intact
- + Reinforce exposed soil near high-activity areas
- + Opportunities for Natural Processes Education

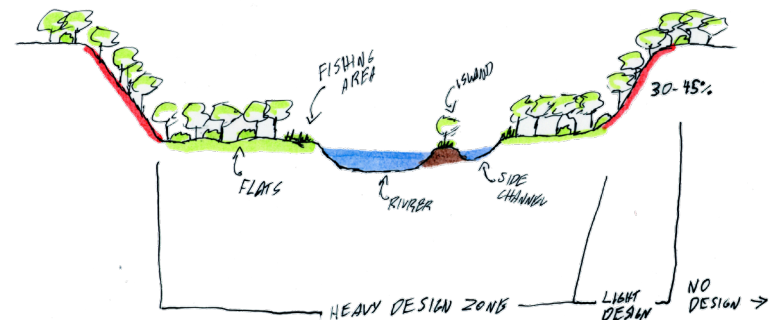
Gorge Masterplanning - Typologies

CLIFFS + ISLANDS



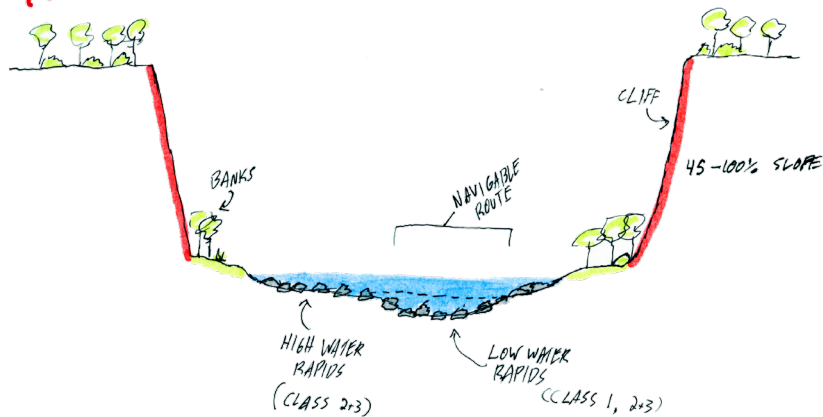
New Typology Combinations
following Dam Removal

LOWLANDS + ISLANDS

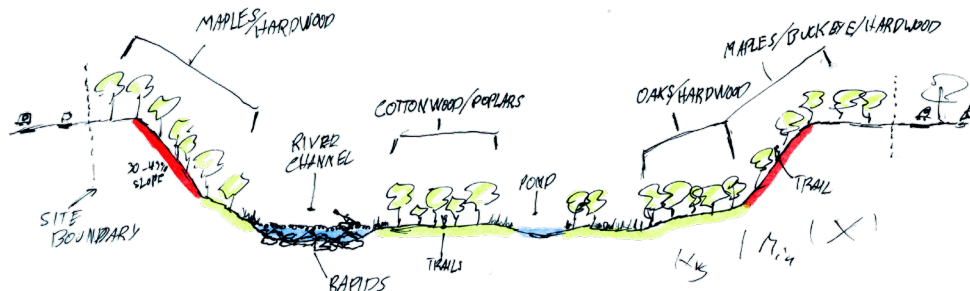


GRASSES
- SEDGES
- BIG/SPAL
- BLUE STEM
- FOWL MANNA US
- FRINGED BROME
- SLAUGH GRASS
- RIVULY GRASS
- WIRE GRASS
- BRUIE CORDON
- WOOL GRASS

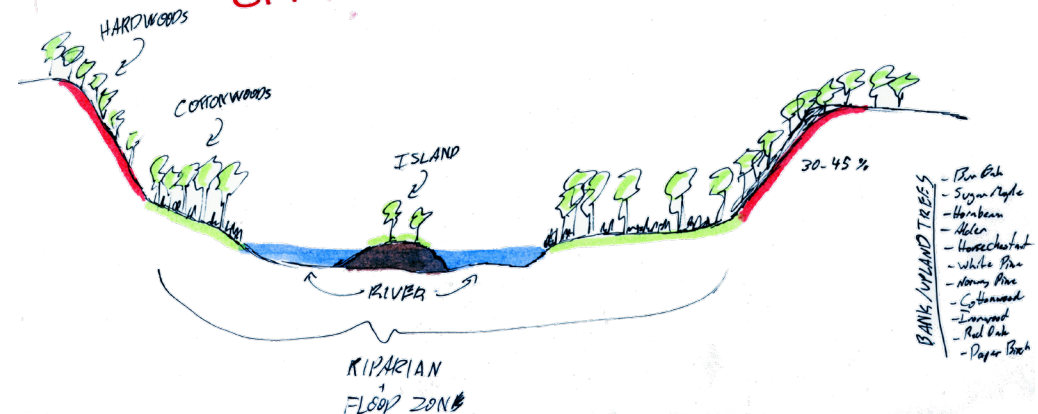
RAPIDS + CLIFFS



RAPIDS + LOWLANDS

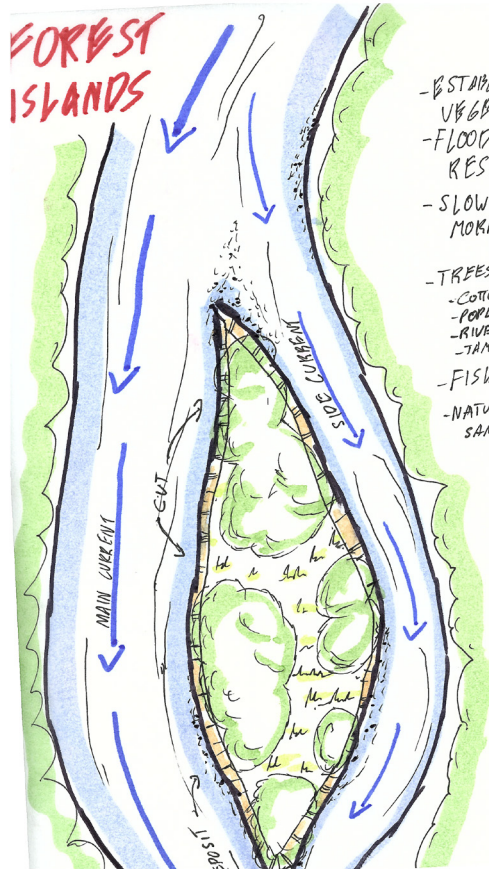


CHANNEL + NEW LOWLANDS/BANKS



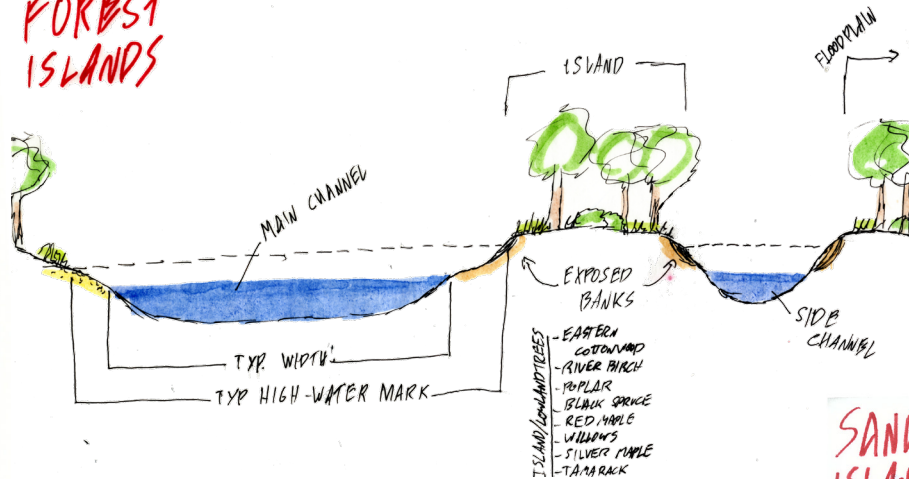
BANK/ISLAND TREES
- Red Oak
- Sugar Maple
- Hornbeam
- Alder
- Hopschestnut
- White Pine
- Norway Pine
- Cottonwood
- Larchwood
- Red Oak
- Paper Birch

Gorge Masterplanning - Islands



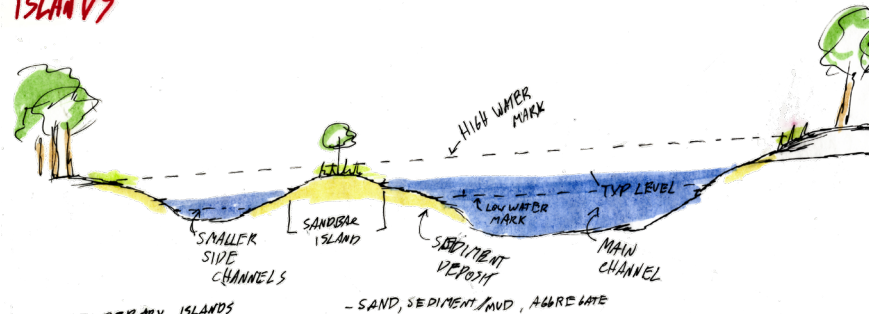
- ESTABLISHED VEGETATION
- FLOOD RESILIENT
- SLOW MORPHOLOGY
- TREES (ISLAND)
 - COTONWOOD
 - POPLAR
 - RIVER BIRCH
 - TAMARACK (CANOPY)
- FISH HABITAT
- NATURAL WILDLIFE SANCTUARY

FOREST ISLANDS



- ISLAND/LOWLAND TREES
- EASTERN COTONWOOD
 - RIVER BIRCH
 - POPLAR
 - BLACK SPRUCE
 - RED MAPLE
 - WILLOWS
 - SILVER PUPLE
 - TAMARACK

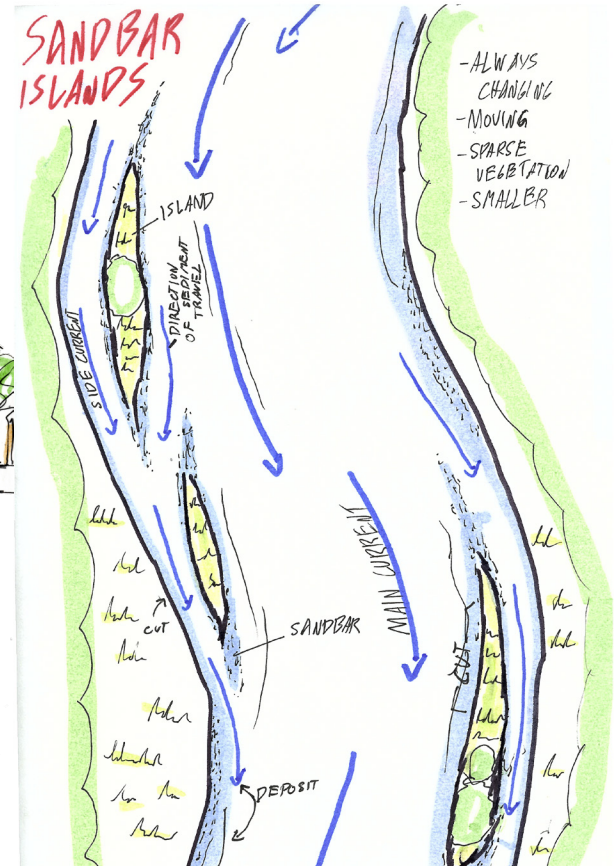
SANDBAR ISLANDS



- TEMPORARY ISLANDS
- MAX 3' ABOVE WATER LEVEL
- RECREATION DESTINATIONS
 - KAYAK / CANOE
 - LUNCH / FISH SPOTS
 - BEACH PARTIES

- SAND, SEDIMENT, AND, ALGAE MAT

SANDBAR ISLANDS



- ALWAYS CHANGING
- MOVING
- SPARSE VEGETATION
- SMALLER

Masterplan - Current Site

Lower St. Anthony Falls
Lock & Dam

Submerged Meeker Island Lock

Ford Lock & Dam

Master Key

 Mississippi River Channel

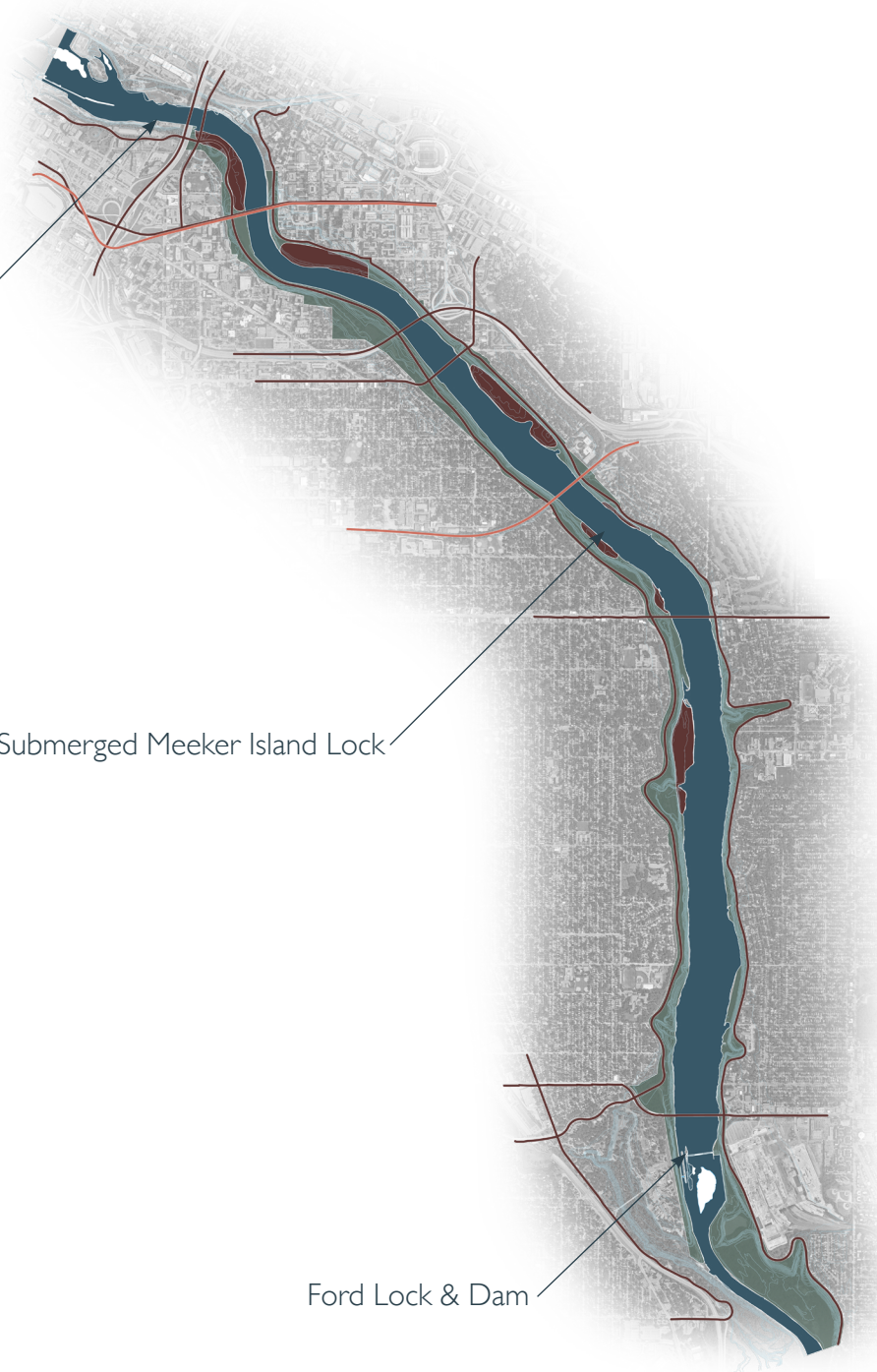
 Lowland Typology

 Park Boundaries

 Topography Lines

 Major Roadways

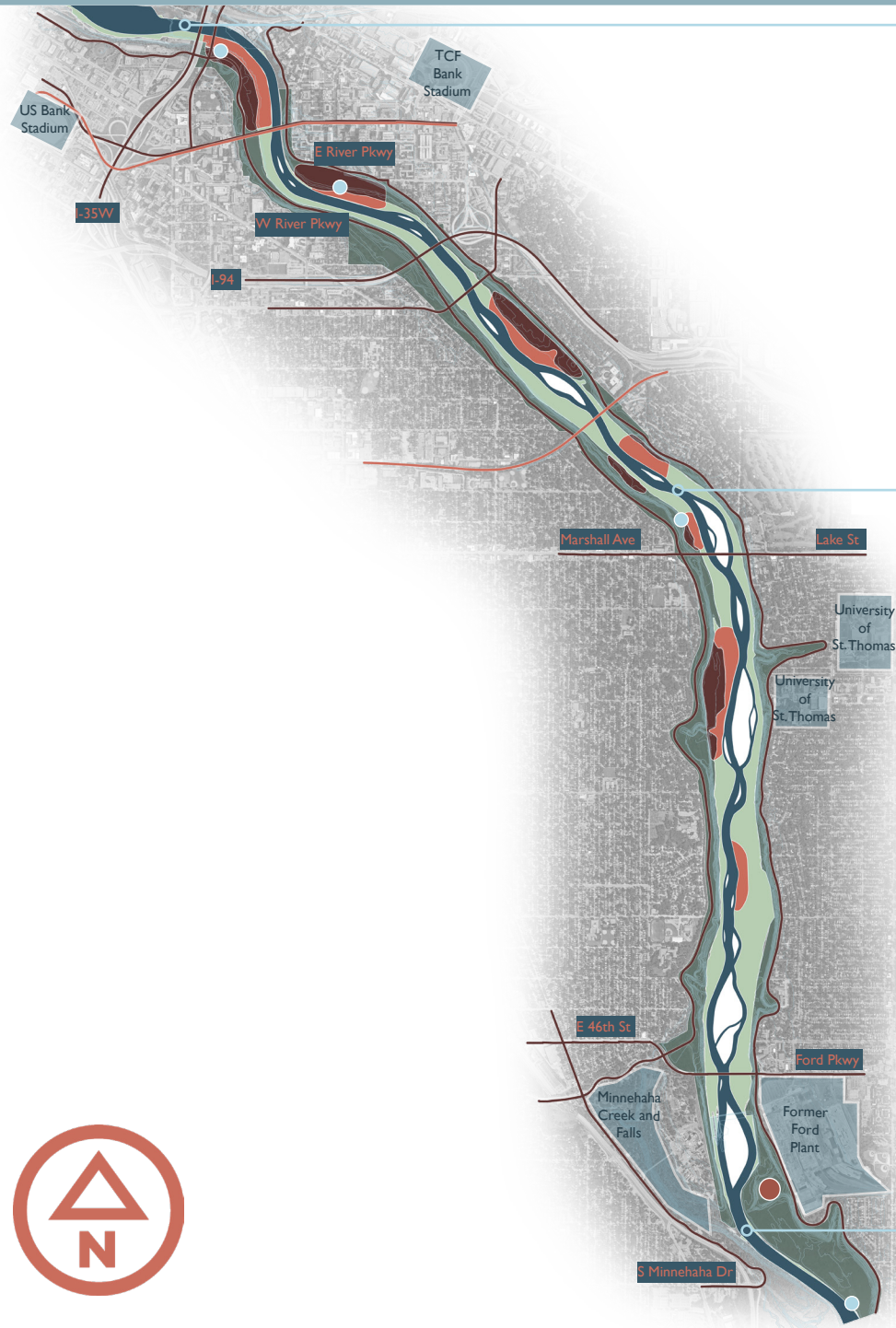
 Railroads



Masterplan - Mississippi River Gorge

Master Key

-  Mississippi River Channel
-  Lowland Typology
-  Park Boundaries
-  Newly Exposed Land
-  New Islands
-  New "Fishing Areas"
-  Topography Lines
-  Major Roadways
-  Railroads
-  Water Access Points
-  Learning Center Site
-  Reference Points



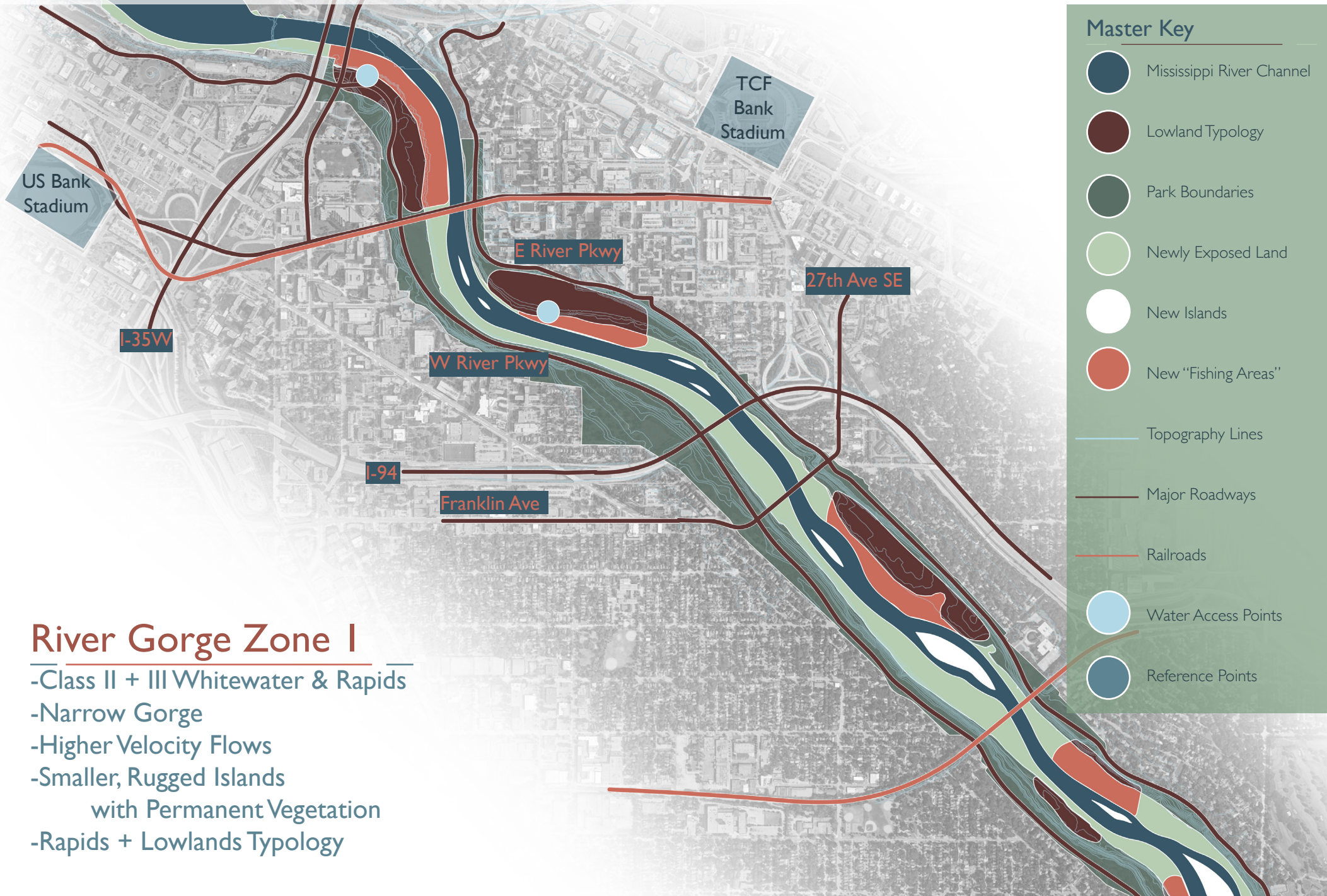
River Gorge Zone I

- Class II + III Whitewater & Rapids
- Narrow Gorge
- Higher Velocity Flows
- Smaller, Rugged Islands with Permanent Vegetation
- Rapids + Lowlands Typology

River Gorge Zone II

- Class I + II Whitewater & Rapids
- Wide Gorge
- Lower Velocity Flows
- Meandering Channels
- Larger Islands
 - Forest + Sandbar Typology
- Cliffs, Banks, and Lowland Edge Typologies

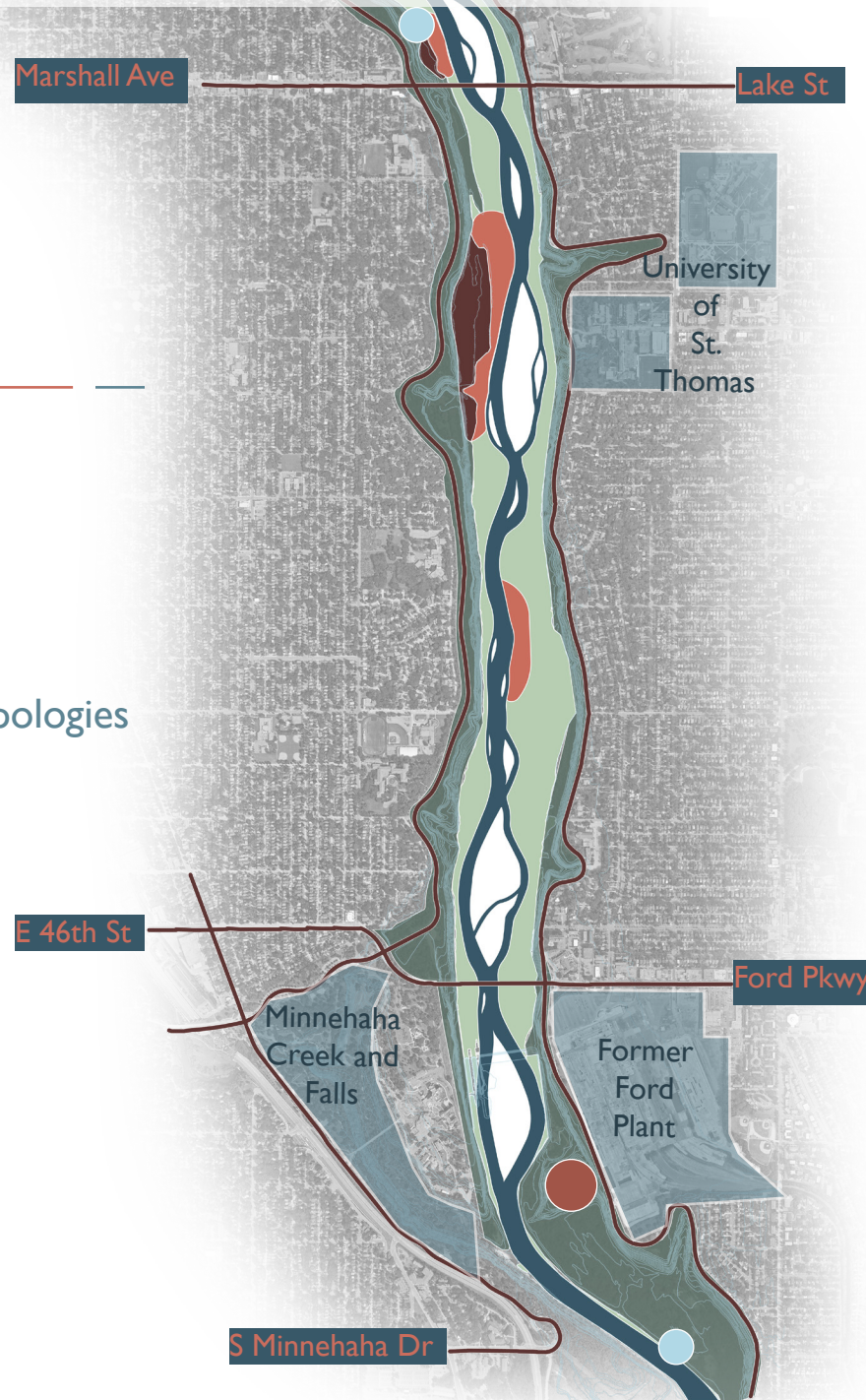
Masterplan - Zone I



Masterplan - Zone II

River Gorge Zone II

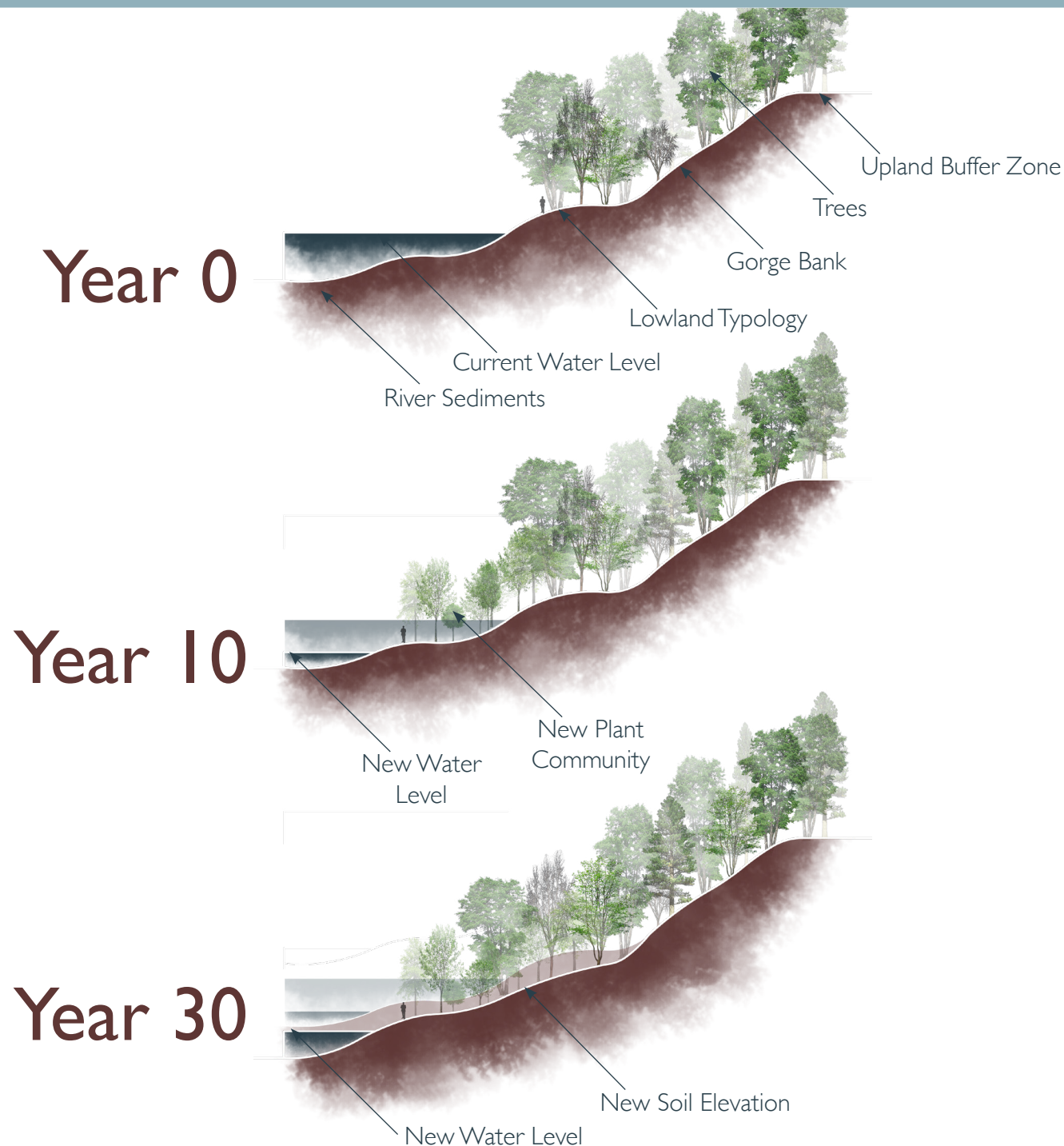
- Class I + II Whitewater & Rapids
- Wide Gorge
- Lower Velocity Flows
- Meandering Channels
- Larger Islands
 - Forest + Sandbar Typology
- Cliffs, Banks, and Lowland Edge Typologies



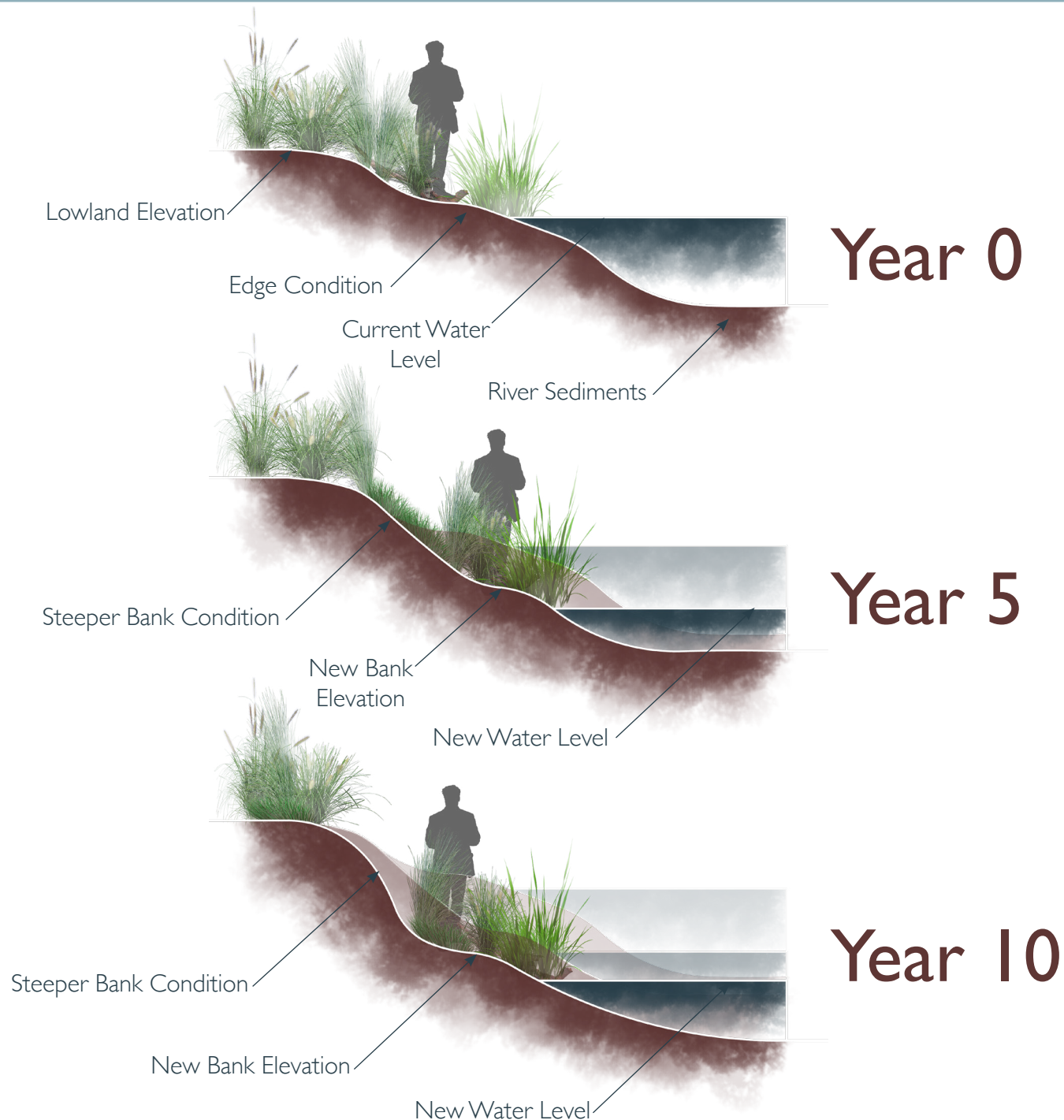
Master Key

- Mississippi River Channel
- Lowland Typology
- Park Boundaries
- Newly Exposed Land
- New Islands
- New "Fishing Areas"
- Topography Lines
- Major Roadways
- Railroads
- Water Access Points
- Learning Center Site
- Reference Points

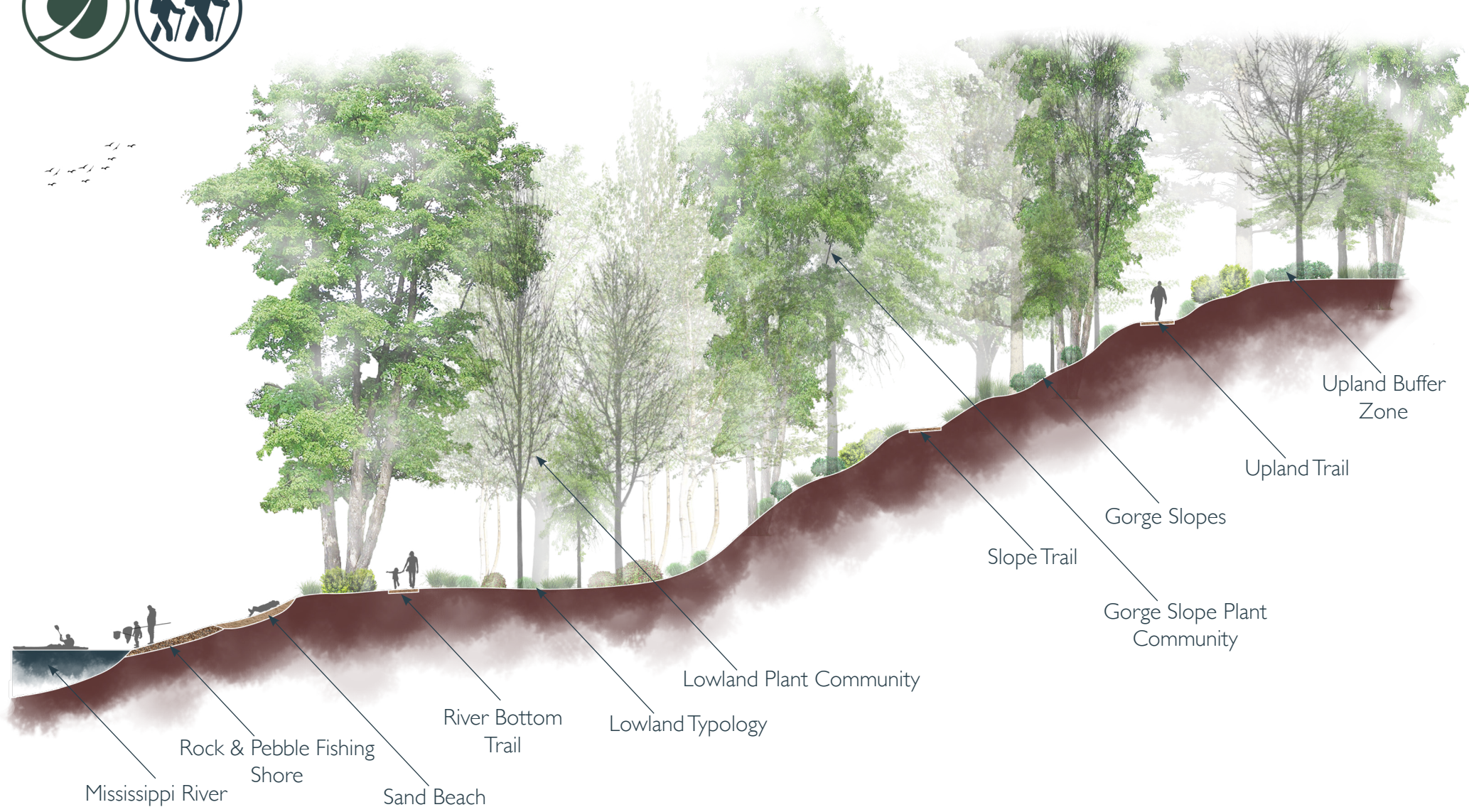
Water & Soil Shifts - Gorge Slopes



Water & Soil Shifts - River Banks



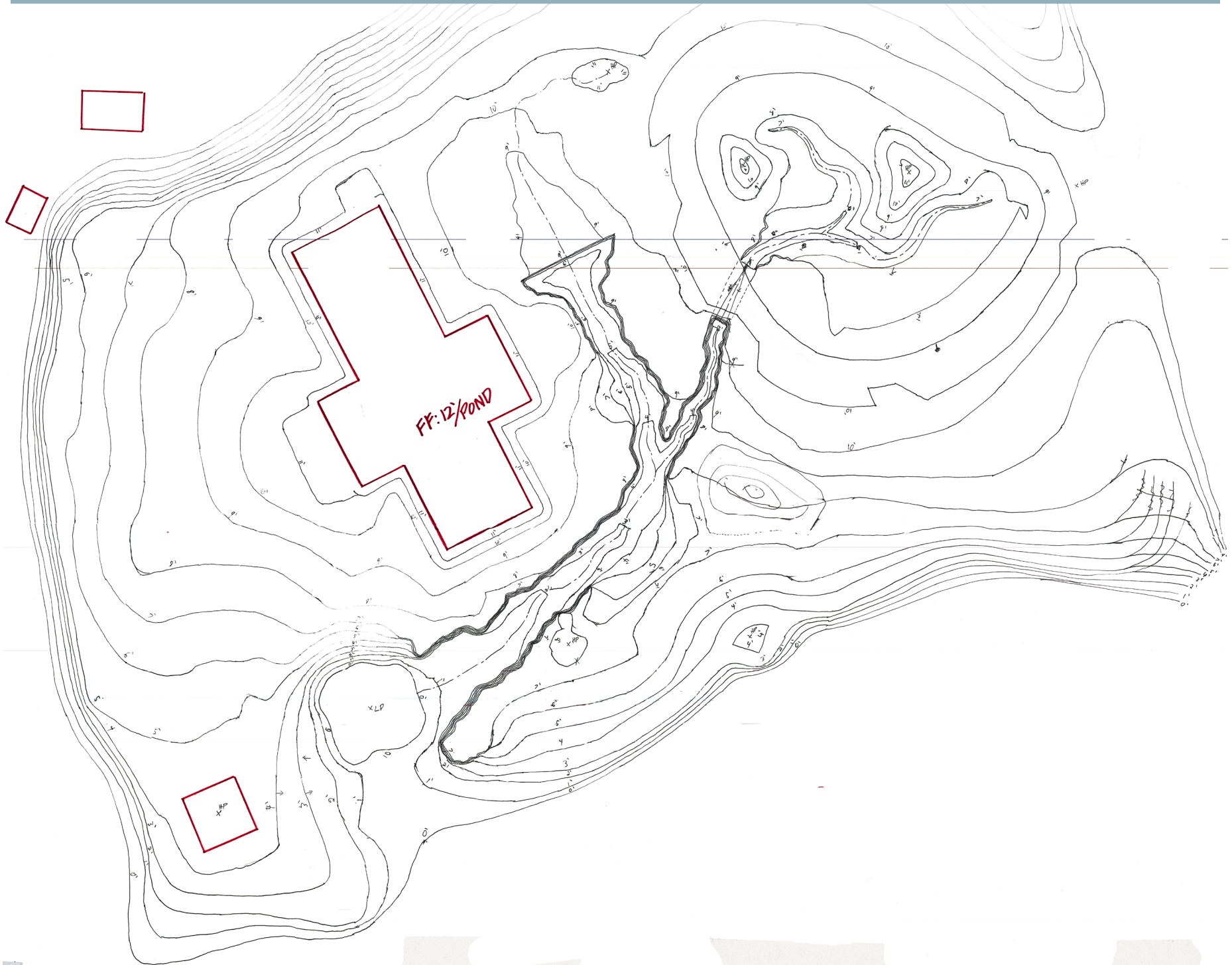
New Fishing Area & Lowlands



Site Plan - Current



Site Planning - Design Development



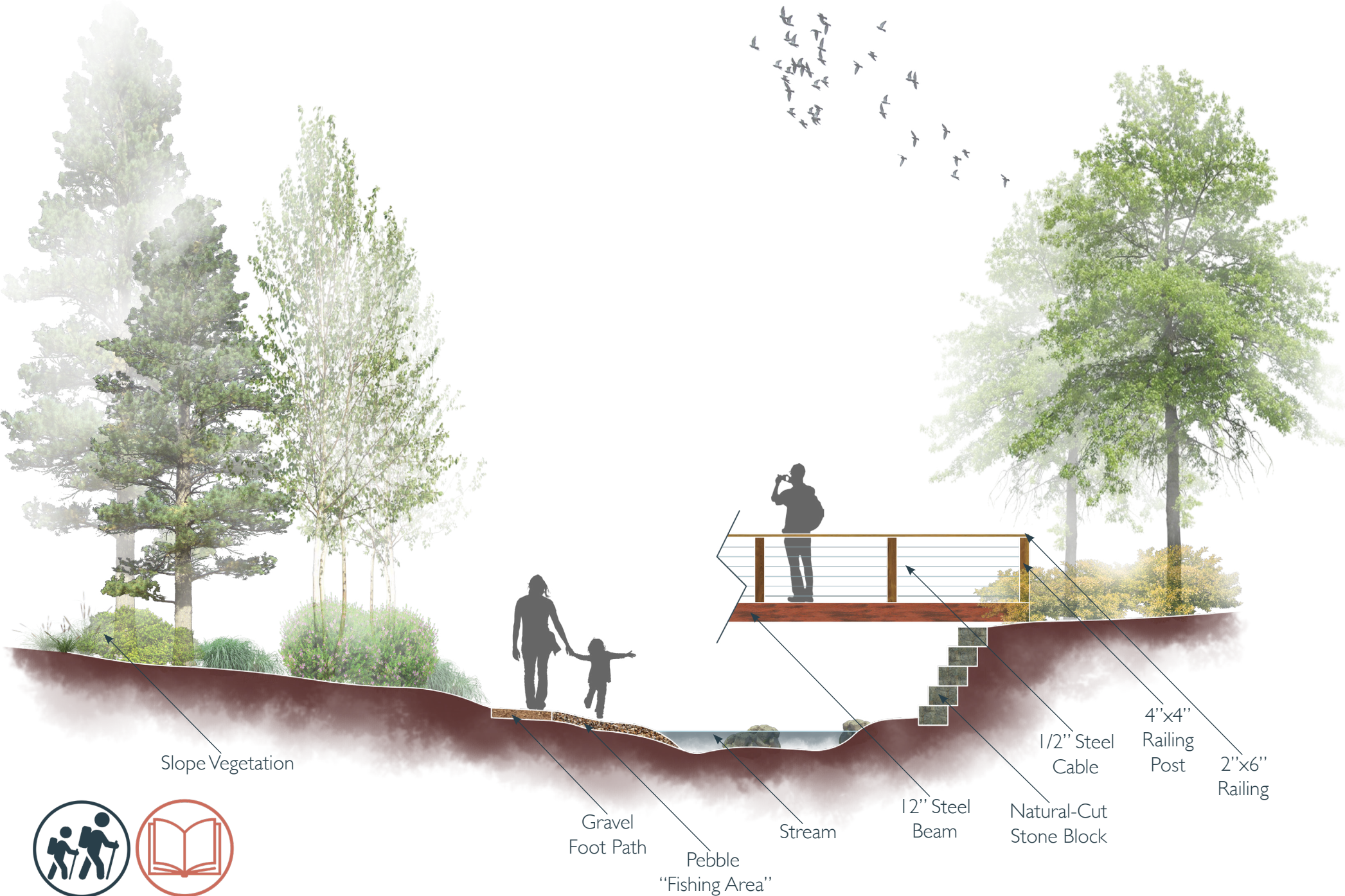
Site Plan - River Gorge Learning Center



Learning Center Entrance & Stream Dam



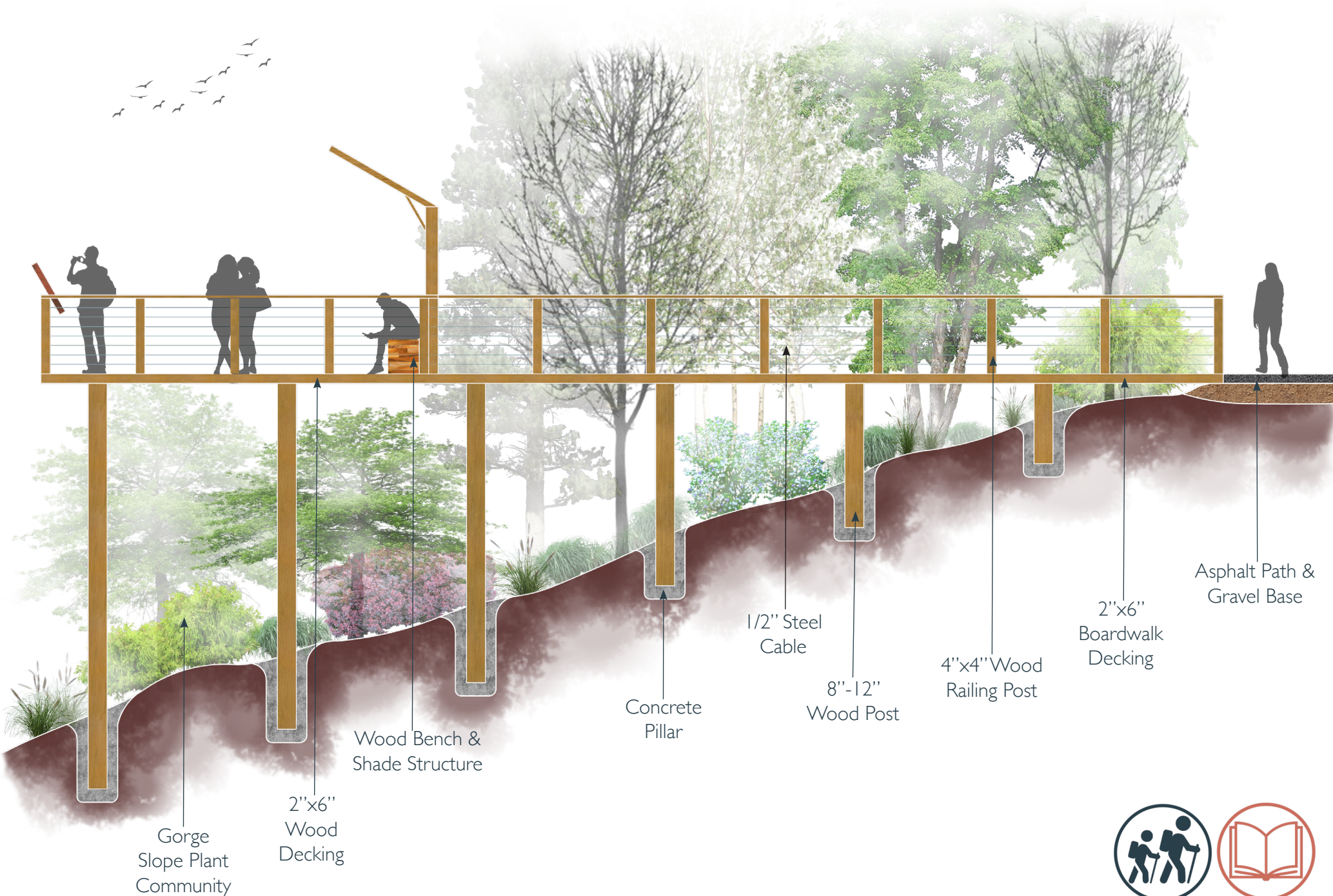
Stream & Bridge Detail



Learning Center Trails & Tower



River Gorge Overlook Detail



River Gorge from Lookout Tower



Research Hypothesis

As **LOCK AND DAMS** continue to become **DEFUNCT** around the country, how can **PLANT COMMUNITIES** best be used to **RESTORE** unique habitats and **CONTROL** erosion while also **SERVING** local communities and **SOCIETY** as a whole?

Conclusions

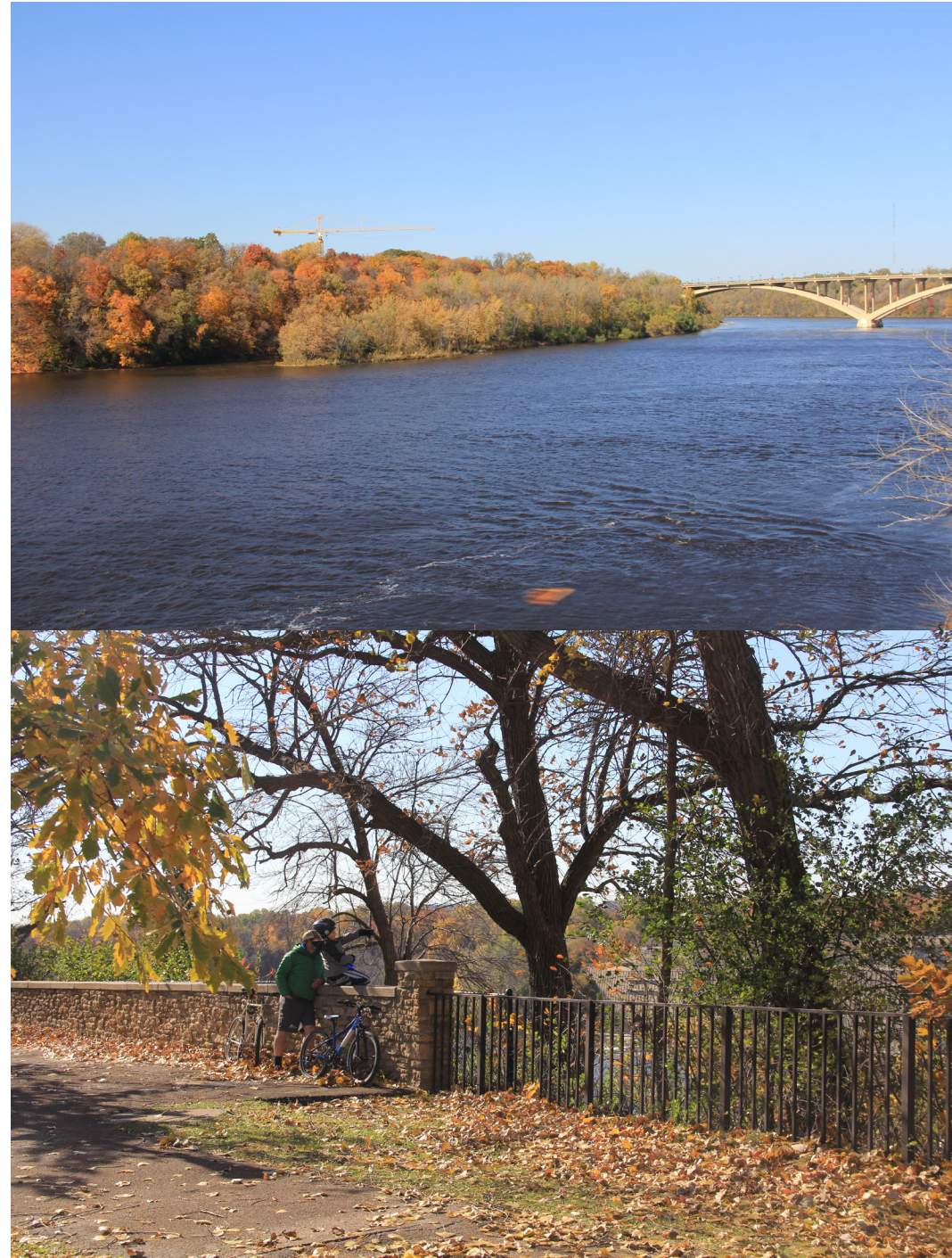
Return of Natural Riparian Systems

Restored Riparian Habitats

New & Improved Recreational Opportunities

Improved Urban Nature Park

Long-Term Tax Dollars Saved



Rivers Will Remain

“Men may **dam** it and say that they have made a **lake**, but it will still be a **river**. It will keep its **nature** and bide its time, like a caged animal alert for the slightest opening. In time, it will **have its way**; the dam, like the ancient cliffs, will be **carried away** piecemeal in the **currents**.”

-Wendell Berry

Questions?

Thank You



Michael L. Stottler

Thesis Research & Design

LA 572 | Jay Kost | Matthew Kirkwood | Spring 2019